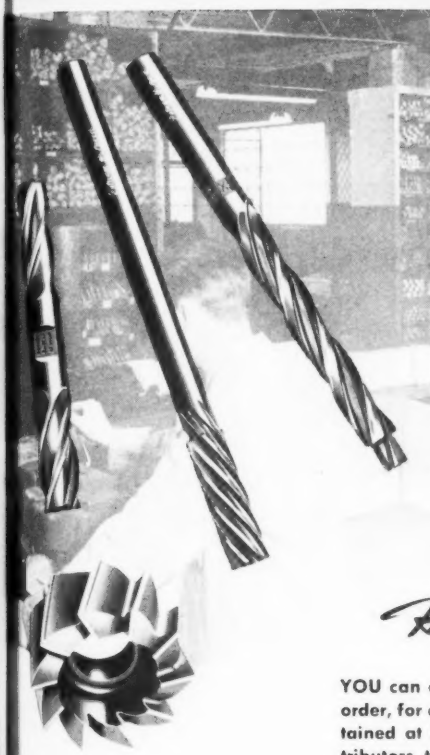
TOOL & DIE JOURNAL



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Forging and Casting Division

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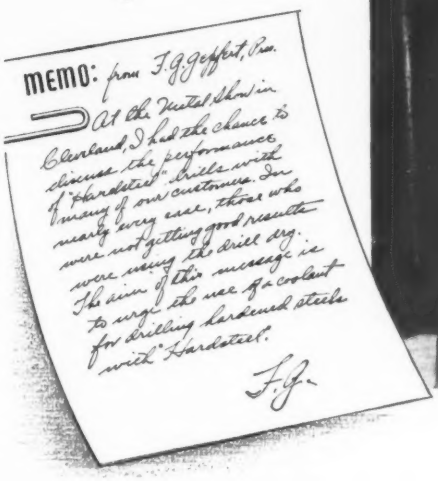
"HARDSTEEL" DRILLS

with Coolant

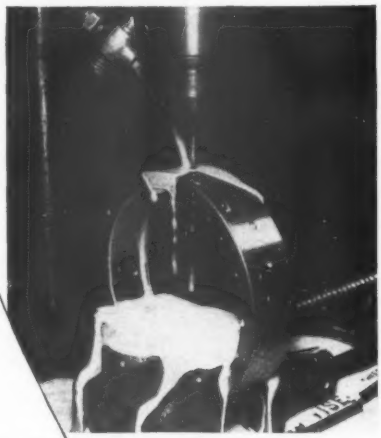
DRILL HARDENED STEELS

faster and better!


memo: from F.G.Geffert, Pres.

At the Metal Show in Cleveland, I had the chance to discuss the performance of "Hardsteel" drills with many of our customers. In nearly every case, those who were not getting good results were using the drill dry. The aim of this message is to urge the use of a coolant for drilling hardened steels with "Hardsteel".

F.G.



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Tool & Die Journal is published monthly for those industry key men who constitute, in each plant, the Cycle of Buying Influence—CBI—and who are responsible for the design, manufacture and use of production tooling.

Subscription rate: To Schools, Libraries, Students, and other than CBI, $3.00 per year. Single copies fifty cents.

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TOOL & DIE JOURNAL

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Vol. XII, No. 6 **September, 1946**

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Die Designers Specify

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SOCKET HEAD INTERNAL WRENCHING **STRIPPER BOLTS**

SOCKET HEAD STRIPPER BOLT

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STRIPPER BOLTS are used to attach the Stripper to the punch in Die Work and for attaching cams, links, levers and oscillating machine parts. H-K Socket Head Stripper Bolts may be set up tightly in close corners. More turns on the key may be made in restricted working areas. It's the Internal Wrenching!

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Yes, ease of operation is a good reason why so many plants are enthusiastic about GEMCO Shapers. For one thing, GEMCO'S are easier to get "used to". All controls are within easy reach of the operator. For each operation or machine function, the controls are exactly where they ought to be. Thus, it's easier for the operator to get the feel and to lead the machine through a series of precision operations or to do just rough machining.

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Send for Bulletin 1003X illustrating and describing Model No. 0 Keyseater, and showing list of standard and special equipment available. Write today.

Specifications

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5. Table size ..... 17" x 18"
6. Longitudinal movement of table .... $4\frac{1}{2}$"
7. Diameter of cutter bars which can be used ..... $\frac{1}{2}$", $\frac{5}{8}$", $\frac{13}{16}$", 1", $1\frac{5}{16}$"
8. Diameter of column ..... 4"
9. Floor space required ..... 33" x 52"
10. Weight of machine crated ..... 2000 lbs.
11. Weight of machine boxed for export ..... 2000 lbs.
12. Cubic contents of box when shipped export ..... 67 cu. ft.
13. Code word bare machine, without equipment ..... BADLY
14. Code word machine furnished with standard equipment ..... BAKER

Baker Model No. 0 Keyseater, Crank Action Type

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ARMOURCLAD FIBRE COMBINATION DISC!

Armour Abrasives Cut Clean and Fast, Last Longer

To meet today's big demand for your products, you'll need the fastest tools and the best abrasives possible . . . tools and abrasives that will do your jobs more efficiently, more economically.

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Put the "POCKET SIZE MACHINE SHOP" to work

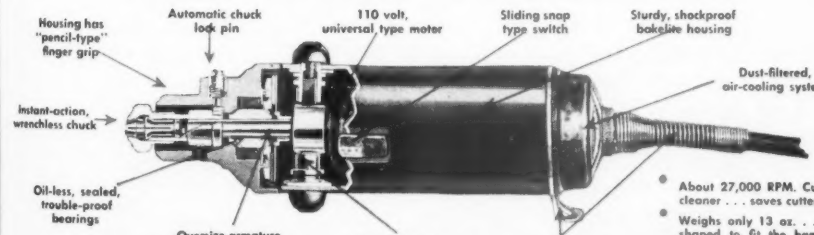
Moto-Tool Kit No. 2. Has 23 accessories and Model 2 Moto-Tool in self-closing, fine wood case.....$33.50.
Moto-Tool No. 2 with one emery point.....$16.50

Dremel's improved, "pocket size machine shop" . . . the famous Moto-Tool . . . can save you hours, by speeding up work now being done by hand. It cuts, grinds, routs, carves, engraves, cleans and polishes. Invaluable as a sharpening tool alone . . . for taps, drills, gouges, chisels, tools and cutters (without tearing down "set-ups"). Moto-Tool is a "war veteran" . . . Thousands of them were used at far-flung maintenance bases by every branch of the armed forces. For years such plants as General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Northrup, Douglas, etc. . . . have bought Moto-Tools for use in tool rooms and on production lines. If your Mill Supply Distributor doesn't carry Dremel Moto-Tools and accessories, write the factory or nearest Dremel representative for information.

Moto-Tool Stand (left) frees both hands for manipulating work $4.50

Stand and Shaping Table (right) aids accuracy in routing and grinding...$7.00

LOOK FOR THESE MOTO-TOOL FEATURES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Handy hanger hook, cord protector

- About 27,000 RPM. Cuts cleaner . . . saves cutters.
- Weighs only 13 oz. . . . shaped to fit the hand.
- Dynamically balanced for vibrationless operation.

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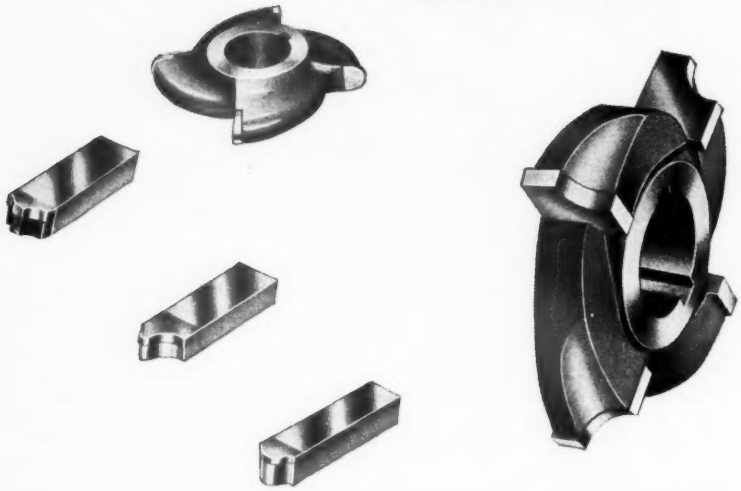
STEP UP PRODUCTION 500%

With Meyers Carbide Tipped Formed Tools



On actual production runs, Meyers generated Carbide Tipped Tools have boosted production more than 500%.

This amazing increase was due to use of special Meyers equipment designed and engineered by our Engineering Department. Increased costs force you to get the most out of your machine tools—Meyers generated carbide tipped form tools will give you more pieces per hour—more pieces between grinds—and a much smoother finish. Let us help you improve your production and cut your costs. Send us your prints for quotation.

W. F. MEYERS COMPANY, INC. • *ESTABLISHED 1888*

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Here's a fast, economical method for cutting high quality Embossing Dies!

Courtesy Cadillac Stamp Co.

GORTON 3-Dimensional Pantograph Rough and Finish Cuts Die for Stamping Aluminum Bottle Caps at One Setting in One Hour

This large eastern manufacturer recently received an order for a die for embossing aluminum milk bottle caps. Nothing like it had been cut prior to the order so no set procedure had been established.

The job was tooled up on several machines in an effort to find out which would produce the most satisfactory results in the least amount of time. The outcome was definite and decisive. Of the machines used, the Gorton 3L Pantograph gave the best performance. Not only did it turn out the best die but turned it out in the record time of one hour.

Adaptable to Light Production Milling and Engraving Operations

Gorton Pantographs have no equal in the performance of intricate milling and engraving operations. They can be used for the profiling of grooves, contours and other shapes; for the cutting of dies and molds; for engraving numerals and designs in any machinable material; and for numerous other purposes. A special roll attachment makes it possible to work from a flat master or model around rolls, dies, dials, knurls up to 6" in diameter. Gorton Pantographs are available in two and three dimensional models to handle many sizes and types of work.

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Perhaps some of the work at which you are now engaged could be accomplished better, faster and with greater economy on a Gorton Pantograph. If you will submit detailed prints of your job to Gorton Engineering Service, our engineers will thoroughly investigate the possibilities and send you a complete report of the results. This service is offered free and without obligation.

JOB FACTS!

NAME OF PART—Milk Bottle Cap Embossing Die—Used in the manufacture of aluminum milk bottle caps.

MATERIAL—Tool steel—hardened and chrome plated after.

MACHINE—Gorton 3-Dimensional Pantograph, Model 3-L.

OPERATIONS—
1. Rough within .001"; depth .008"; speed 2300 r.p.m.
2. Finish in one cut, depth .001"; speed 2300 r.p.m.

TIME—One hour.

FREE... Complete Information

For complete information on the Gorton Pantograph, write today for Bulletin No. 1655.

GEORGE GORTON MACHINE CO.

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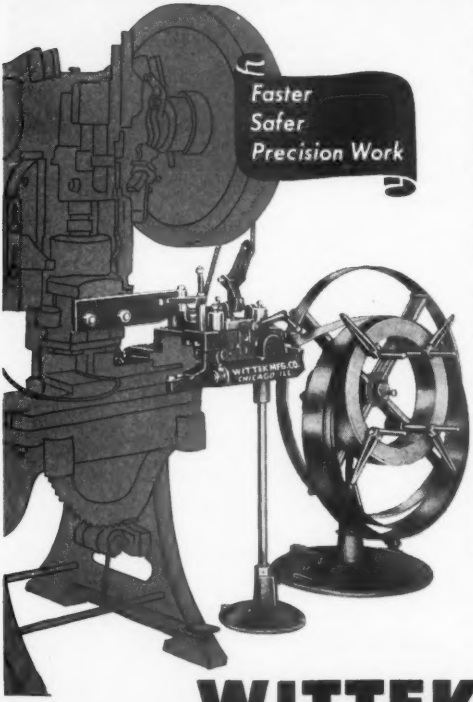
Planning Peacetime Production Using Coiled Strip Stock?

Equip with
WITTEK
Automatic Roll Feeds and Reel Stands



Wittek Roll Feeds are being used extensively by war plants in their large volume production of high quality metal stampings. The flexibility of Wittek Roll Feeds will assist these plants in their peacetime conversion through their adaptability to various jobs. Keen competition will demand the utilization of equipment to its point of highest efficiency. If your postwar plans include punch press production of parts from coiled strip stock—investigate now the many possibilities of Wittek Roll Feeds and Reel Stands.

Write for catalog, prices and recommendations

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MANUFACTURING CO.
4305-15 W. 24th Place, Chicago 23, Ill.

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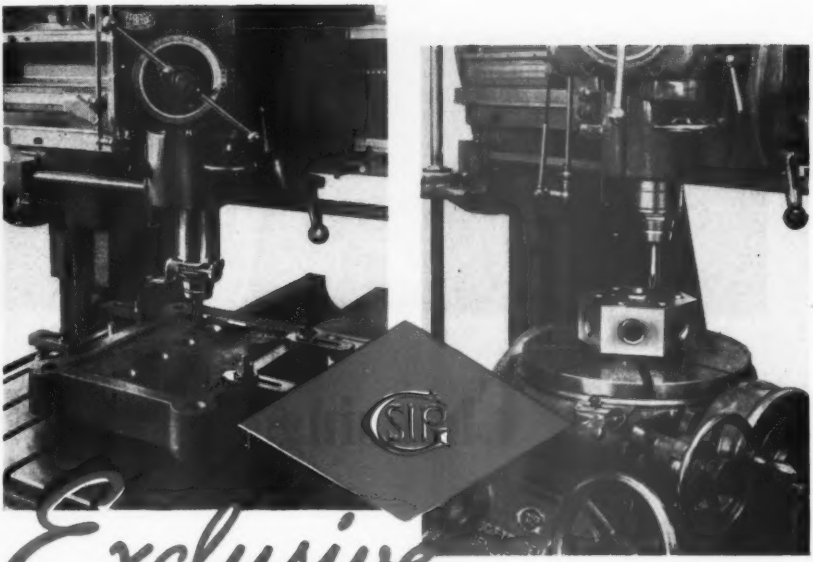
ROLL FEEDS
AND
REEL STANDS



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. . . PRECISION *and* VERSATILITY!

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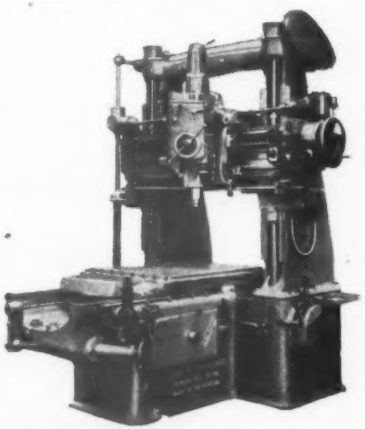
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
Hydroptic (illustrated)	39½" x 32"
No. 5G	43⅜" x 32"



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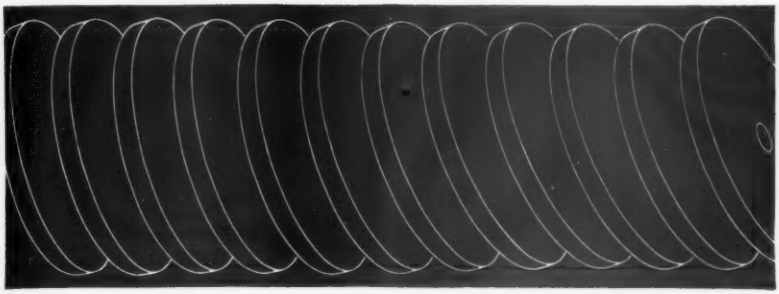

in a Million!

that give better grinding at minimum cost. His thorough analysis of your grinding operations provides a dependable double check on their efficiency. Often, he can offer a practical suggestion for improvement. For he is fully aware of the latest developments in abrasives and their application. What is more, his very business brings him in daily contact with a variety of modern grinding jobs.

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When you call in CARBORUNDUM, you receive cooperation that assures you of getting the most out of your grinding operations and abrasive wheels. The Carborundum Company, Niagara Falls, New York.

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ABRASIVE GRAINS AND COMPOUNDS

for:

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Pressure Blasting
Finishing

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◀DI-ACRO is pronounced "DIE-ACK-RO".

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Whether you require standard or special sizes, you can be sure of getting the right tool for each metal cutting job when you specify NATIONAL Tools.

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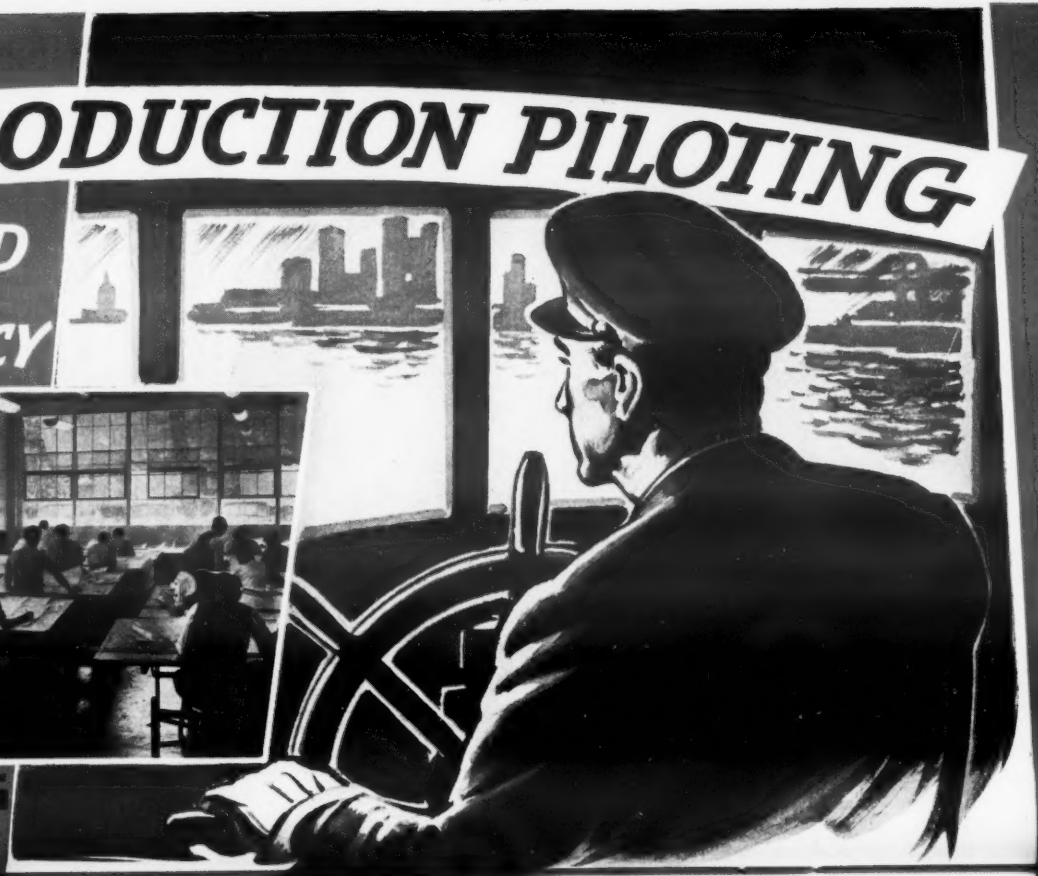
Twist and Slot Divisions — Wilcox Rotex Co.

PRODUCTION PILOTING

for SPEED and EFFICIENCY



ENGINEERING and BUILDING

- of jigs
- gauges

Expert production piloting is becoming increasingly essential with each passing

exceed their phenomenal war production records—an attainment that would

- of jigs
- gauges
- fixtures and
- special machinery

• • •

PRODUCT DESIGN

• • •

PROCESS ENGINEERING

• • •

PLANT LAYOUT & ROUTING

• • •

EXPERIMENTAL & DEVELOPMENT ENGINEERING

Expert production piloting is becoming increasingly essential with each passing week.

Various costs are rising, while the productivity of labor is said to be decreasing.

To offset this trend and operate with a justifiable profit, still greater tool productivity and efficiency are necessary.

Operations must be cut. Output must be increased. Greater accuracy must be attained. New lows must be reached in the rejection of imperfect parts.

This requires tool engineers to exceed their phenomenal war production records—an attainment that would have been considered absolutely impossible a few years ago.

But success begets success and the truly experienced organizations go forward constantly to greater and greater attainments.

With a record of experience and success second to none, we invite you to discuss your tooling problems with us regardless of their nature, extent or complexity.

Upon request, we'll gladly send a representative or the new bulletin showing McKinney facilities.

THE McKINNEY TOOL & MFG. CO.

1673 ARABELLA ROAD — CLEVELAND 12, OHIO

DESIGNERS AND BUILDERS OF PRECISION TOOLING SINCE 1920

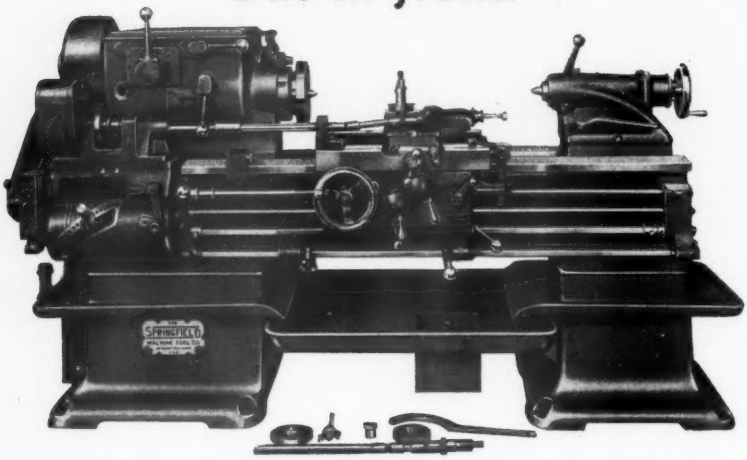
McKINNEY

JIGS · FIXTURES · GAUGES · MACHINERY AND CUSTOM MACHINING

Complete Engineering Service

SPRINGFIELD PRECISION LATHE

Out in front!



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Tailstock . . . all bearings and bed ways oiled from one well.

From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

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Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO, U. S. A.

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CUT MAN HOURS!
FASTER CUTTING ACTION—Pace setting CHICAGOS, backed by half a century of experience, are skillfully engineered to turn out work in less time, to increase production per man-hour, cut costs!
Come to headquarters for the greatest variety of top quality accessories available . . . mounted and grinding wheels in all grades, grains, shapes and sizes . . . tool and cutter wheels . . . cups . . . internal wheels . . . wheels for center lapping machines . . . drum sanders and bands . . . wire brushes . . . felt and rubber polishers . . . miniature cutters.
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THE NEWEST, FASTEST METHOD OF POSITIONING BENCHWORK

HOLD AND TURN WORK 360° AT ANY ANGLE

DOWRARM UNIVERSAL POSITIONER

Holds all types of benchwork firmly in ANY position, at ANY angle and permits the workman to do a faster, better job by enabling him to work freely with BOTH hands. Change position and angle of work on horizontal, vertical or axial planes quickly and easily as desired, and lock it with fingertip hydraulic control.

Holds work up to the worker. Reduces fatigue. Increases work capacity, productivity and accuracy. Reduces man-hours per job, accidental damage and hazardous work methods.

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High Carbon-Chrome Steel

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—is the world's largest producer of 52100 tubing.

—is the only source of 52100 steel in the three finished forms; tubes, bars and wire.

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—has the world's largest battery of controlled atmosphere furnaces for annealing 52100 steel—thus assuring minimum decarburization and maximum machinability.

—has consistently led the industry in the development and application of 52100 steel for those machined parts where an oil hardening steel of good wear resistance is required.

These advantages coupled with a thoroughgoing Job Analysis Plan and follow-through to final use in customers' plants, assures your complete satisfaction. Write or phone Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

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A good company with which to do business — 26 years Designing and Building Experience — Specialist staff of Engineers and Craftsmen, competent in Precision Work — 175 modern machines in streamlined plant . . . Estimating service without obligation.

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Designed for press production, the stamped products reaching the American Home—the new washing machine, electric ironer, stoker and metal cabinets—create a new design for living. The once messy basement becomes a modern, pleasant workroom.

Wherever stamped products are being turned out, Danly Die Sets and Die Makers' Supplies guarantee precision, speed die making programs and cut "down time," because Danly means *known dependable accuracy*.

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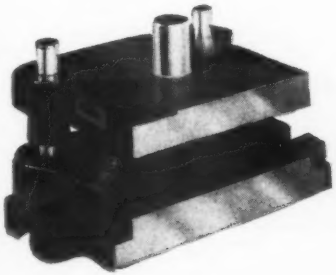

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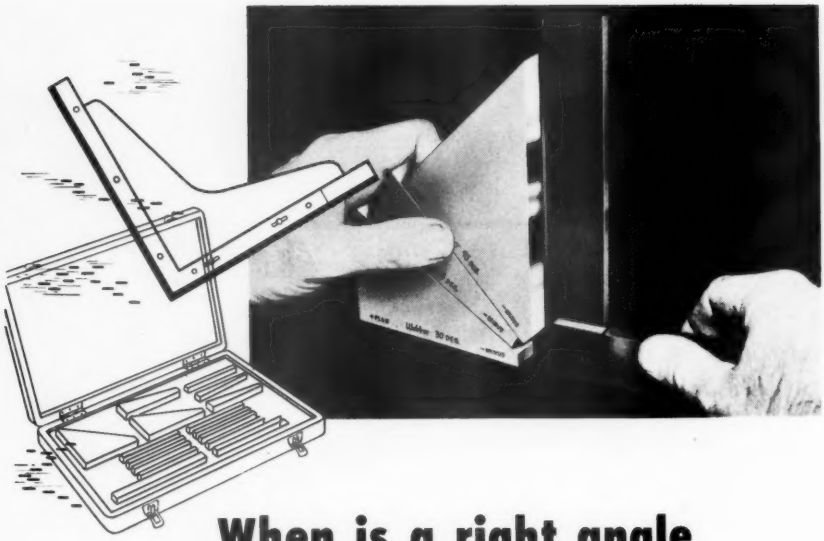

When is a right angle an absolute 90°?

Right angles are the most frequently recurring angular measurements in industry, yet it is quite likely the absolutely perfect angle is being obtained for the first time in routine shop practice with the recently developed Webber Angle Gage Blocks. The simplicity of angular measurements is apparent in an adjacent illustration. The figure shows a combination of 3 blocks which total 90°.

By a similar combination as many as 356,400 separate angles are obtained. It simplifies and improves on the sine bar method. Compound angles are obtained easily. Absolute accuracy is assured as the proof is contained within the blocks themselves. An almost instantaneous check makes errors well nigh impossible.

Ask for bulletin that outlines shop practice in angular measurements.

WEBBER GAGE COMPANY · 12903 TRISKETT RD. · CLEVELAND 11, OHIO

WEBBER MAKES PRECISION GAGE BLOCKS EXCLUSIVELY

- ★ Gage Block Sets in Steps of .00005"
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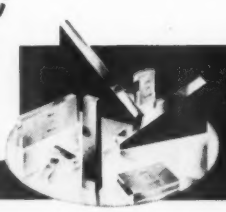
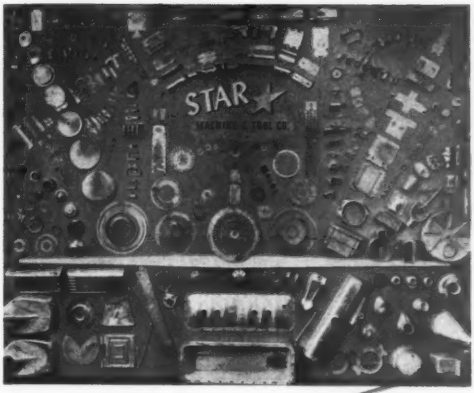
- ★ Heavy Duty Gage Blocks.
- ★ Angle Gage Blocks in Steps of one second.
- ★ Carblox (Carbide) Wear Gages.



Webber
PRECISION
GAGE BLOCKS



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Operated independently of the tool and die shop, Star maintains unusual production facilities. Star is capable of starting from your blue print or sample and carrying your job through tooling to final assembly.

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7″ SHAPER

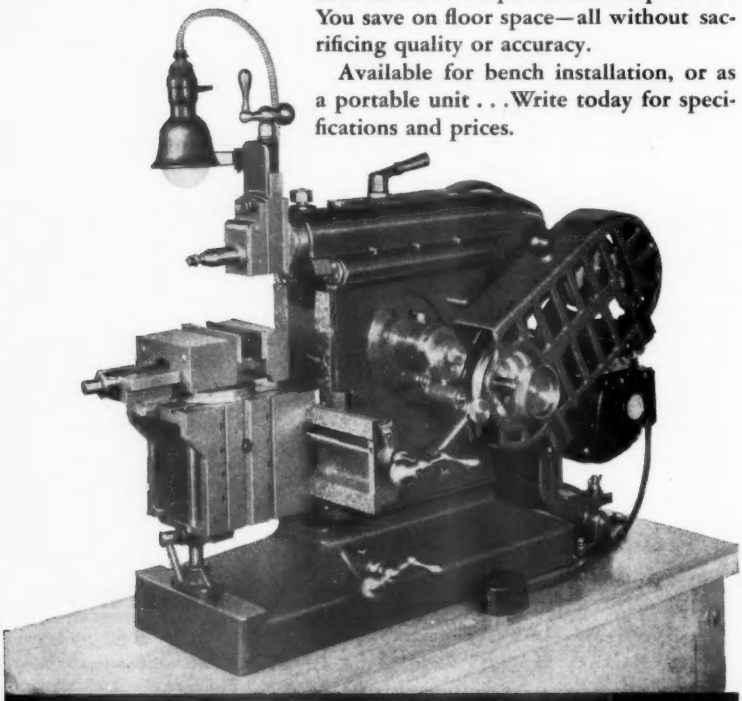
--A precision machine

meets postwar needs for accuracy, speed and economy

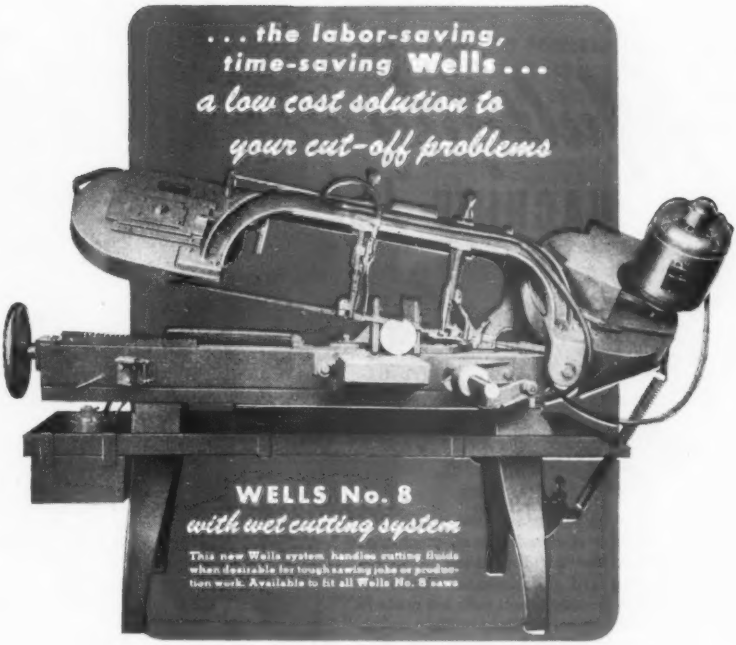
If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



AMMCO 2100 COMMONWEALTH AVENUE NORTH CHICAGO, ILLINOIS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a low cost solution to
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WELLS No. 8
with wet cutting system
This new Wells system handles cutting fluids when desirable for tough sawing jobs or production work. Available to fit all Wells No. 8 saws

YOU WON'T find a better answer to all-around metal sawing problems than a versatile Wells. On miscellaneous cut-off jobs around the plant, or on steady production work, they can always be kept busy.

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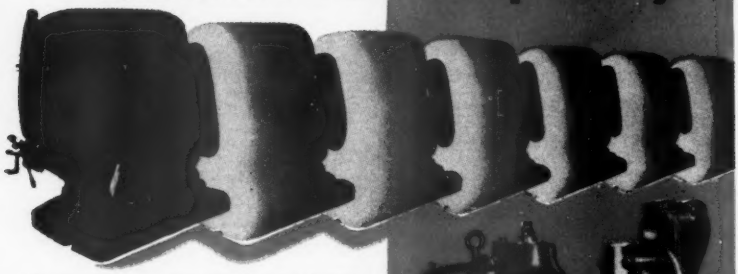
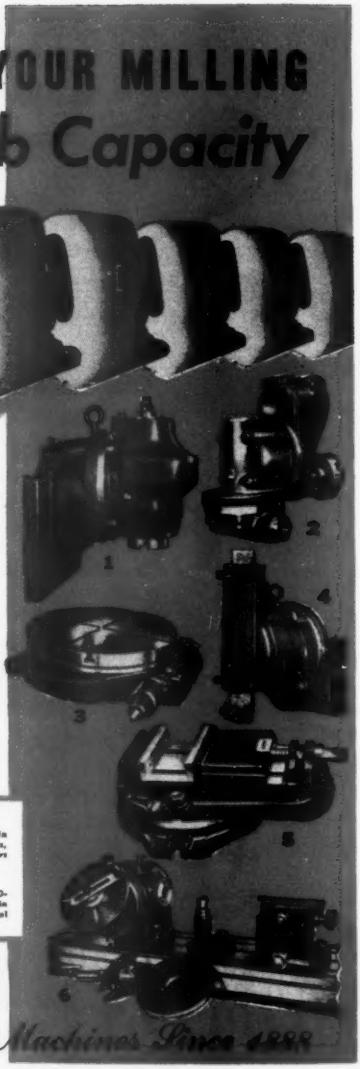
Multiply YOUR MILLING MACHINE Job Capacity





Do you want to increase the productiveness of your standard milling machines? Then consider the application of Kempsmith standard attachments. These dependable, precision-built tools are made to perform the most delicate milling operations with both speed and accuracy. They are the product of 57 years' specialized experience, manufacturing milling machines exclusively. The same high degree of rigidity and precision, characteristic of Kempsmith Milling Machines, is embodied in these standard attachments. It will pay you to investigate. Write for literature.

THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH Standard Milling Attachments

1 VERTICAL HEAD converts horizontal to vertical machine, retaining identical spindle characteristics

2 HI-SPEED UNIVERSAL for high speed angular milling in all planes.

3 CIRCULAR TABLE for milling circles or cams, gear cutting, high-speed continuous milling, etc.

4 SLOTTER for keyseating, broaching, general slotting, tool and die making, etc.

5 VISES, both plain and swivel types, adaptable to special jaws to save fixtures.

6 UNIVERSAL DIVIDING HEAD for plain indexing and spiral milling

KEMPSMITH

Precision Built Milling Machines Since 1898

"More Profitable than Politics or Stamping Silver Dollars"

- K. R. Wilson

THIS 100-TON KRW HYDRAULIC PRESS BRAKE PRODUCES JAMB SECTIONS FOR 2,000 WINDOWS A DAY AT A FRACTION OF THE COST OF HEAVIER EQUIPMENT . . . HOLDS WORKER FATIGUE TO A MINIMUM

This press had been in operation only a few days before the Wendling Iron Works of Buffalo ordered three more . . . that's how satisfactory it proved in use. Now it is turning out 4,000 jamb sections, for 2,000 windows (illustrated below), in two 8-hour shifts a day. No longer is it necessary to buy tons of unnecessary weight in a press in order to get efficient production. KRW welded construction plus scientific distribution of stress and load has radically changed all that. This 100-ton KRW press weighs a fraction, and costs a fraction of comparable equipment.

Because this press is hydraulically operated and not mechanically driven, it is quiet and almost vibrationless in operation. The press cannot be jammed by careless operation . . . the platen can be stopped and reversed at any point in its travel. Two heavy-duty cylinders develop controlled pressure to perform the work. Pressure is perfectly equalized between these cylinders by the exclusive KRW mechanical linkage and torque bar arrangement. Pump equipment varies depending upon customer requirements. This press can be engineered as a gap type or with open or closed ends. Write for details, or better still, tell us what you want to accomplish and we'll quote you specifically. Mail the coupon.

QUIET

IT WOULDN'T WAKE A BABY

Easy, even hydraulic pressure does the work. No jarring impact as the die bottoms. No shock to the worker to lessen efficiency.

VIBRATIONLESS

GLASS OF WATER ON THE PLATEN, YOU'LL NEVER SPILL A DROP

That's how evenly pressures are distributed over the unit. That too, is another reason why dies last longer in a KRW.

DEFLECTION NIL

NO SWAYBACK PLATENS TO WORRY ABOUT

Where pressures require it, bed rails, platens and head are trussed and ribbed to eliminate any deflection. Press illustrated stamps three jambs per stroke.

Specifications

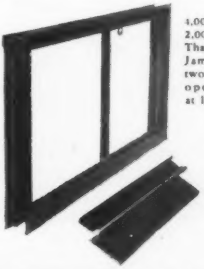
KRW 100-TON PRESS BRAKE

Upper Platen	2½" x 14" x 44"
Lower Platen	2" x 12" x 44"
40 Strokes per minute	
Floor Space Req. Incl. Power Plant	42" x 80"
Overall Height	94"
Weight Incl. Power Plant	5,500 lbs.
Ram Pressure 100 tons	
Automatically Controlled Stop	

Can be made as gap type, or with open or closed ends. Distance between uprights and length of platens can be increased or decreased, depending on your needs.

DIES QUICK DELIVERY TO YOUR SPECIFICATIONS

We have arranged dependable connections for the manufacture of all types of dies for KRW Press Brakes. Send us your blueprints and specifications for accurate costs and delivery date.



4,000 jamb sections, 2,000 windows a day. That's production. Jamb is formed in two operations, first operation shown at left.

NAME YOUR NEEDS

WE'LL QUOTE PRICE AND QUICK-DELIVERY DATE...FILL OUT AND MAIL COUPON

K. R. WILSON, 215 Main St., Buffalo 3, N. Y. 18

Please give me the facts regarding the KRW 100-ton Press Brake.

Name .....

Address .....

City ..... Zone ..... State .....

Capacity and size needed ...

.....

K. R. WILSON

BUFFALO 3, NEW YORK

OILSTONES

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NORTON ABRASIVES

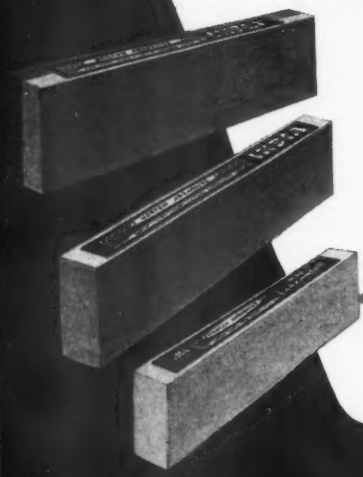
For FASTER Industrial Sharpening

Three distinctive qualities commend Norton Abrasives Oilstones for improved industrial sharpening; (1) factory oil-filling, (2) complete selection range of both natural and electric furnace abravises, (3) reputation for continued excellence sired in the "Pike" craft-tested tradition since 1823. Factory oil-filling retards glazing and speeds up cutting action. Complete selection range insures greater choice from the coarsest vitrified stones to the surgical fineness of quarried Arkansas mineral. Reputation for excellence guarantees full-value service.

For faster cutting industrial oilstones, Norton Abrasives offer four celebrated brands:

India—aluminum oxide—oil-filled
Crystolon—silicon carbide—oil-filled
Arkansas—natural Novaculite—hard and soft
Washita—natural Novaculite—open structure

Write for booklet, "How to Sharpen."



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(DIVISION OF NORTON COMPANY)

ALSO QUALITY COATED ABRASIVES SINCE 1872

Capacity

ONE COMPLETE ENGINE BLOCK

per minute!

Ultra-modern broaching machine built by Cincinnati Milling Machine Co. 8 tons of Circle-C used for six sets of tools.

broached with solid inserts of CIRCLE-C Super High-Speed Steel

Forty-eight flat broaches equip this enormous and powerful machine tool used for broaching and machining 8-cylinder cast-iron engine blocks.

The machine builder insisted on the finest high-speed tool steel obtainable for broach inserts.

***Circle-C Super High-Speed Steel* was selected by a committee of technical experts because of its recognized reputation for quality, its uniform hardenability and its unequalled cutting capacity.**

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STEEL COMPANY

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NORBIDE* INSERT IN ANVIL

Eliminates Necessity for Lapping

Buyers and users of visual gages will be interested in this application of a wear-resistant NORBIDE piece. A flat, molded NORBIDE piece has been inserted in the anvil at a point where the greatest wear will occur. Field reports indicate that many NORBIDE inserts have been in constant use for over a year with no attention having been given them, other than for inspection. Less wear-resistant anvils, on the other hand, usually have to be frequently relapped to be kept in condition. NORBIDE is the trade-mark for Norton Boron Carbide—the hardest material made for commercial use. It has had wide and successful use as wear-resistant parts for a variety of measuring devices. Ask your regular supplier about NORBIDE gages or for further information write to:

NORTON COMPANY, Worcester 6, Mass.

NORBIDE*—The Hardest Material Made by Man

NORTON BORON CARBIDE

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HEAT TREAT SMALL PARTS

In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door — Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand — For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$146.00*
MH-4	10"W 6"H 18"L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE — Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

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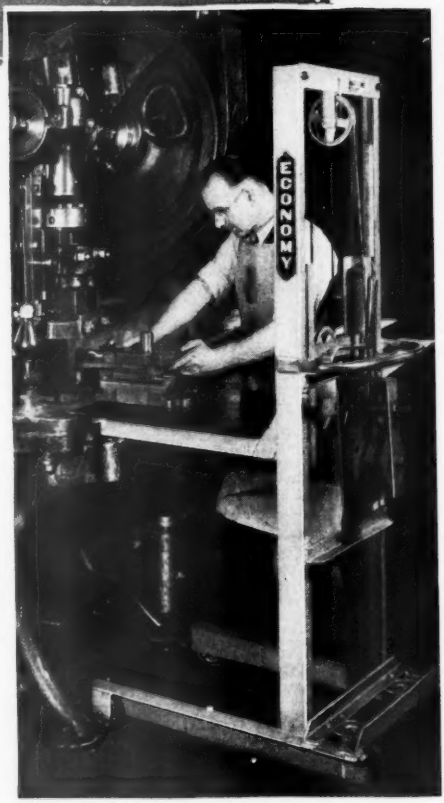
INDIANAPOLIS MACHINERY EXPORT CORP.

Export Manager, 44 Whitehall Street, New York, New York

Save production time with a SHOPLIFTER



- **Light, Compact**
- **Easily Moved About**
- **One-Man Operated**
- **Wide Range in Application**
- **Saves Production Time**
  in handling dies and heavy fixtures; stacking barrels, boxes, etc.; loading and unloading trucks

Specifications

Type—D
Capacity—500 lbs.
Overall height—72"
Platform lift—54" above floor level, lowers to within 5" of floor
Baseframe—24" wide x 33" long
Platform—24" x 24", steel plate
Entire frame of machine of structural steel, electrically arc welded throughout
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Crank up and down hoist unit
Two swivel casters and two stationary wheels with push bar furnished
Painted olive green finish
Weight—250 lbs. (approx.)

Heavier capacities up to 5,000 lbs. also available. Write for details.

Prompt Delivery . . . Price $157.50. Full freight allowed

Foot Operated Floor Lock—$10.00 extra

ECONOMY ENGINEERING CO., 2659 W. Van Buren St., Chicago 12, Illinois

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BALL BUSHINGS

FOR LINEAR MOTIONS

- **Reduce Wear**
- **Reduce Friction**
- **Reduce Power Consumption**
- **Reduce Lubrication**
- **Reduce Maintenance**
- **Reduce Cost of drive motors, gears, linkages, etc.**

The use of ball bearings for rotating parts is unquestionably profitable — a time tested fact! The economies and many other advantages of anti-friction bearings can now be obtained for linear motions.

Free rolling unlimited travel BALL BUSHINGS cannot cock or bind and will maintain almost frictionless precision alignment. Perhaps the size, weight and cost of your entire mechanism can be substantially reduced by application of BALL BUSHINGS.

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IN EXACT
CONCENTRICITY
ON ANY
SURFACE GRINDER

Designed to Hold All Straight or Taper Shank Tools from 1/16" to 1 1/2" Diameter

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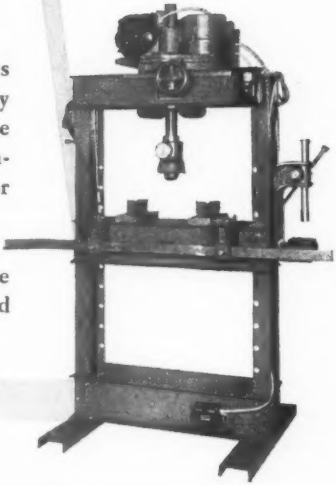
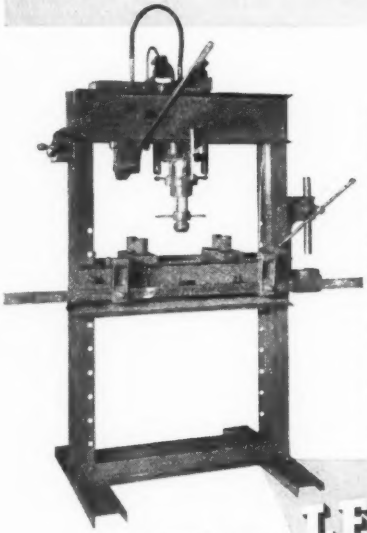
WITH LEMPCO PRESSUREMATIC PRESSES

Lempco Pressurematic Presses will pay for themselves many times in your shop. They can be used for press fitting, assembling, bending, straightening or die tryouts. Pressurematic Presses are made in Electric and Hydraulic models. Pick the one that fits your needs and place your order today.





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Speed . . . power . . . economy . . . make the Lempco Electric Press the outstanding machine of its kind. Available in 20, 40 and 60 ton models. Foot controls free operator's hands for any operation. Builds up from zero to 60 tons in just 4 seconds. Automatic Pressure Control available for this press. Prevents excessive pressure which might damage work. And it also permits press to be used for production runs.

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Two pumping speeds . . . adjustable work head on 60-ton model for easy centering over work . . . long ram travel . . . and other fine features make the Lempco Hydraulic Press the most efficient hand-operated press on the market. Made in 40 and 60 ton models.

LEMPCO

5713 DUNHAM ROAD
BEDFORD, OHIO

Write for free book *that tells how, when and where Lempco Pressurematic Presses can be used to your greatest advantage.*

Standard Model — Range $2\frac{1}{16}$" to $14\frac{1}{2}$".

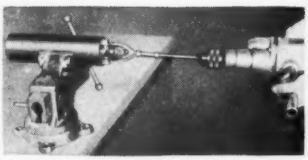
Junior Model — Range 2" to 2.6"

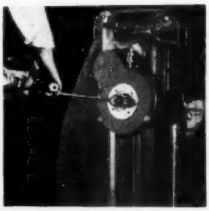
Hone Cylinders from 2" to 14½" in Diameter with Low Cost SUNNEN Portable Cylinder Hones

For small lot production, for repair, salvage or maintenance of operating equipment, Sunnen Portable Cylinder Hones can be carried to the job and require only reasonable skill to produce holes that are accurate within .0005" with as fine a surface finish as is required.

Removes as little or as much stock as required for selective fitting of parts. Driven by portable electric or air drills — or may be used in a drill press, radial drill or lathe. Guaranteed accuracy, .0005" — corrects errors of out-of-round and taper. Can be operated in any position without misalignment.

For complete information on internal honing problems, call in a Sunnen engineer — or write for free bulletin.





SUNNEN

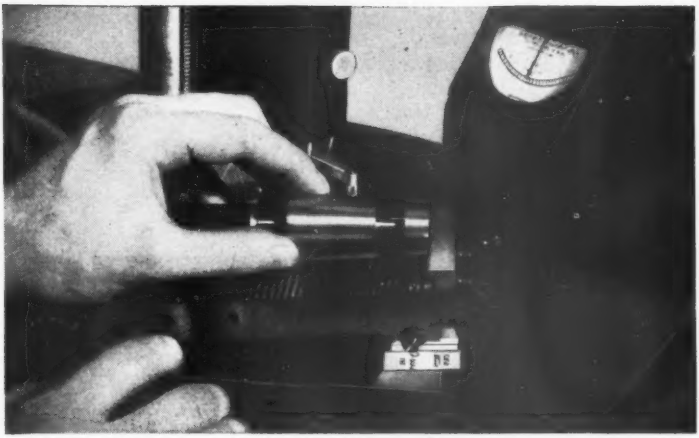
TRADE MARK REG. U. S. PAT. OFF. MARCA REGISTRADA

SUNNEN PRODUCTS COMPANY

7947 Manchester Avenue St. Louis 17, Missouri

Canadian Factory — Chatham, Ontario

149



a ten-thousandth is routine . . . where JO-BLOCKS control by *millionths!*

It PAYS to control parts-dimensions to close limits. It pays in ease of assembly, in product performance and in the assured fit of replacement parts. In wartime, it paid richly in human lives saved. JO-BLOCKS, the pioneer precision controls, produced in America by Ford Motor Company only, for all industry, are warranted accurate to .000002″, .000004″ or .000008″ ±, and are available in sets at $23 and upward, or in individual blocks, with various accessories. With properly selected genuine Jo-Block equipment, accuracy control can be maintained to the highest practical degree over any mechanical dimensional inspection.

FREE—NEW CATALOG!
Profusely illustrated, with full details, covering selection, use and care of Jo-Blocks. Write Ford Motor Co., Johansson Div., Dept. 915, Dearborn, Michigan.

Ford
Johansson
GAGE BLOCKS

SET YOUR MACHINES LEVEL WITH Empco JACKS

Saves set up and re-leveling time

Self aligning on uneven floors

Accurate two-way adjustment

Machine Tool Manufacturers strongly emphasize the need, not only to set machines level, but to KEEP 'EM THAT WAY. Periodic re-leveling is essential for accurate work tolerances. How often, depends on the type of foundation. No method of machine setting is stable enough to maintain the accuracy of initial leveling. It is important to check after first month of operation, then check periodically and re-level whenever necessary.

When a machine is set on EMPCO JACKS the whole operation is the work of only a moment: Simply apply a wrench to the "hex" screw head, turn right to lift or left to lower until your level indicator reads "zero".

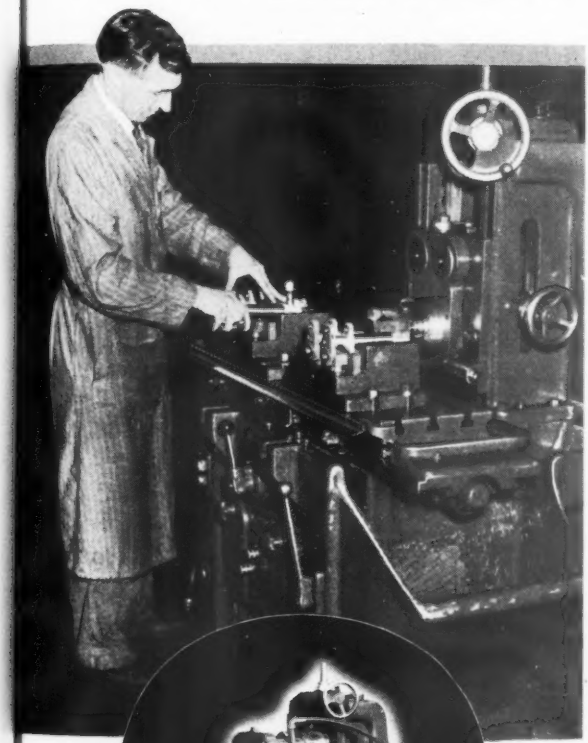
Write for descriptive folder. Prompt delivery.

SIZES AVAILABLE
No. 1...2 " normal height
No. 2...2⅝" normal height
No. 3...3¾" normal height

EMPCO

THE ENTERPRISE MACHINE PARTS CORPORATION
2735 JEROME AVE. DETROIT 12, MICH.

YOU CAN GET MINIMUM IDLE TIME



with CONTINUOUS Automatic Two-way Cutting Cycle on the KEARNEY & TRECKER M-24 Simplex Milling Machine

THE Kearney & Trecker M-24 Simplex milling machine permits continuous operation with minimum idle cutter time.

Cast steel rods shown are being milled to length. Operation is speeded up by use of twin work holding fixtures, each accommodating two workpieces. A carbide steel milling cutter is applied on a continuous, automatic two-way cutting cycle. Automatic hydraulic controls for the table movement make the M-24 Simplex ideally suited to this job.

Kearney & Trecker M Series machines perform a wide variety of milling operations on small or medium-sized parts. Being equipped with a completely automatic and manual control system, they are readily adaptable to long or short run jobs.

CHECK THESE FEATURES

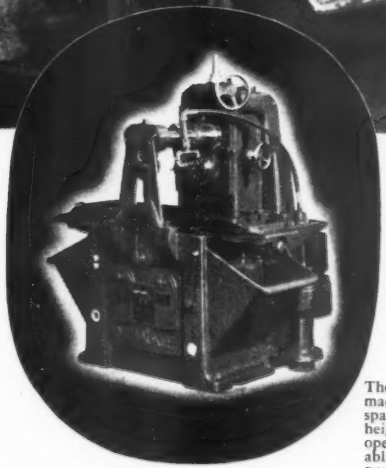
Three bearing spindle, with double overarms, arbor supports and outer arm brace assure maximum rigidity and accuracy.

Climb cutting equipment is standard—includes an adjustable nut and a fixed nut on a ground table feed screw to eliminate backlash in both directions.

Pick off speed and feed gears available for two speed ranges and three feed ranges to meet individual requirements.

Simplified directional controls assure ease of operation.

Built-in coolant and chip disposal system.



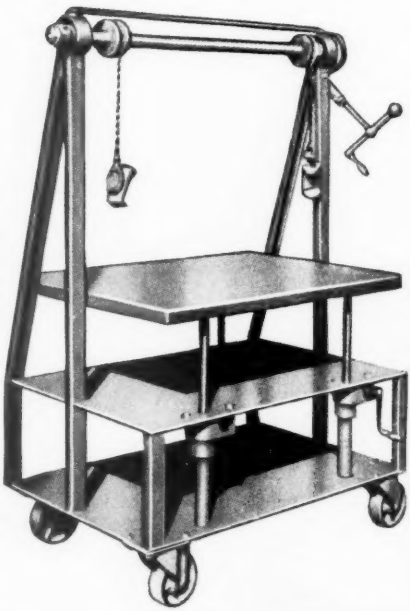
Write for complete data on M-24 Machines — BULLETIN No. B10A. *Please indicate your business connection.*

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

The compact construction of M Series machines reduces the necessary floor space to a minimum. Convenient table height facilitates setup and loading operations. The machines are available with either 18", 24" or 30" of power feed to table.

ONE MAN HANDLES DIES UP TO 3000 LBS!



With the new BARRETT MULTI-DUTY DIE TABLE, one man does everything! Here's a lifting table, work bench, die separator, and floor truck—all in one—designed to save time and energy; cut costs in storing, moving and setting up dies. Note these outstanding advantages:

1. Makes die separation and assembly a simple, one-man job.
2. Handy crank-operated hoist does the heavy lifting.
3. Table is adjustable to height from 24″ to 40″ above floor.
4. All gears are accurately machined and fully enclosed.
5. Husky all-steel construction; electric welded, rigid.
6. Easy to operate; no complicated parts to give trouble.
7. Rolls easily on heavy-duty ball bearing casters.

Offered in two sizes with 44″ x 28″ and 36″ x 24″ tables; safe load capacities from 2,000 to 3,000 pounds. Write today for descriptive bulletins.

BARRETT-CRAVENS CO., 3269 W. 30th St., Chicago

Representatives in All Principal Cities

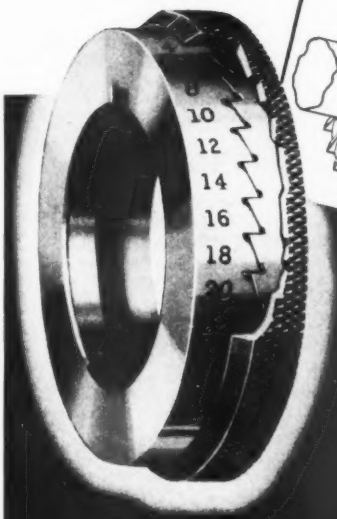
BARRETT

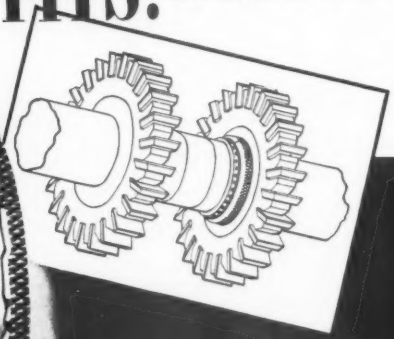
One Man Does More Than 3 or 4 . . . With A Barrett

Barrett Handling Equipment

GIVE 'EM FITS!

Here's how to "fit" the exact spacing requirements between cutters, in straddle or gang milling and multiple slotting setups.





S. J. Adjustable Spacing Collars

—manufactured exclusively by Scully-Jones, can be adjusted to make a perfect "fit," to the exact decimal space needed between cutters, without removing cutters from arbor to mount shims.

These adjustable collars have an expansion of .002" per step and a maximum expansion of .024". The teeth have a three-point bearing, at all times assuring uniform parallelism of the sides. They are hardened and ground and each tooth is ground on the side and face.

Count the Cost—Compare the Accuracy

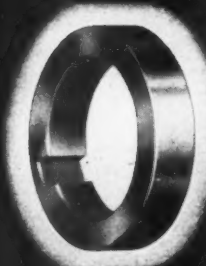
—of Solid Spacing Collars made in your own shop—and you'll choose

S. J. Solid Spacing Collars

These Collars are carefully heat treated,* and widths are ground parallel to .0005 plus or minus.

Prompt delivery can be made on the standard sizes of S. J. Solid Spacing Collars.

*Except sizes of less than 1/8" thick.



See pages 128 and 129 Scully-Jones Catalog No. 500 for Adjustable and Solid Spacing Collars.

Write us for further information.

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1913 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

SOLD! FOR ONLY $2.55

CENTERLESS GRINDER
TIPS OF SOLID COLMONOY

These famous blades, that give you so much longer wear, are inexpensive. For example, a blade 3/8″ (A) by 1/2″ (B) and 10″ long costs only $2.55. You can apply the casting in 35 minutes, using 1/2 oz. of silver solder. Or you can do as hundreds of others do—send your blades to us for complete service and prompt return.

Cut Centerless Grinder Costs Way Down

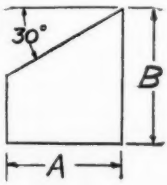
1. With Colmonoy tips you average upwards of ten times the life of hardened tool steel or cast iron blades.
2. You have less breakage—less down time—than with other metals commonly used for tipping blades.

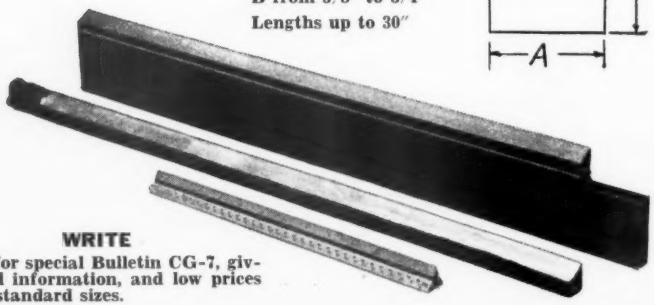
Colmonoy tips for grinder blades are cast in all required sizes and lengths, with a 30° angle.

A from 3/32″ to 5/8″

B from 3/8″ to 3/4″

Lengths up to 30″



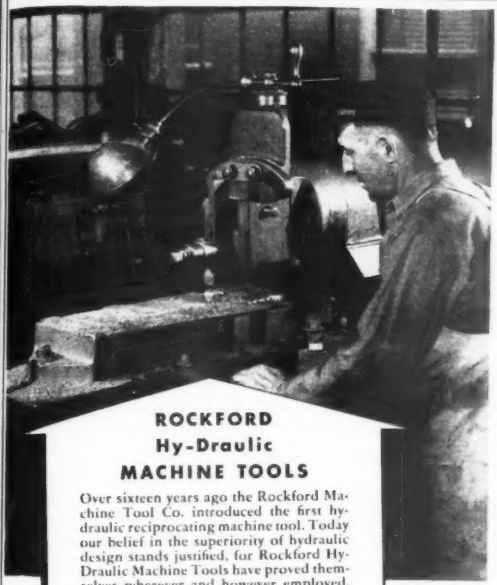


WRITE

Write for special Bulletin CG-7, giving full information, and low prices on all standard sizes.

WALL COLMONOY CORPORATION

7TH FLOOR FISHER BLDG., DETROIT 2, MICH.



4608

ROCKFORD Hy-Draulic MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such basic advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System reverses instantly. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

eyes on the job...

Whether your job is toolmaking, maintenance, or general machine shop work, the ease of Rockford Hy-Draulic shaper operation will be readily apparent. Rate of table feed and cutting speed, and length of cutting stroke are all obtained by simple lever control. Feed, speed, and cutting stroke length can be varied as required while the shaper is in operation. Such operating flexibility and ease are two advantages that result from Hy-Draulic drive and feed. The machine operator is free at all times to keep his eyes on the job. Control levers are all within easy reach.

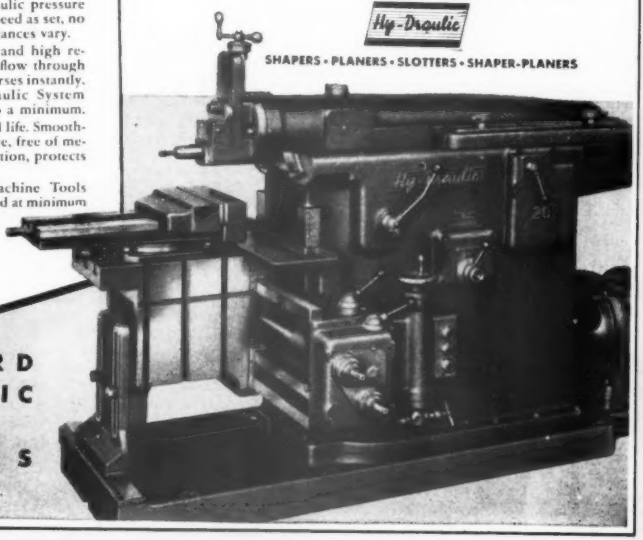
To improve shaper work in your shop . . . to obtain faster work and better work, with minimum operator fatigue, investigate the Rockford Hy-Draulic Ram-type Shapers. Six rated stroke length sizes are available ranging from 12" to 28" stroke. Write for Bulletin 2522

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS

Hy-Draulic

SHAPERS • PLANERS • SLOTTERS • SHAPER-PLANERS



ROCKFORD HY-DRAULIC Ram Type SHAPERS

MO-MAX IS TOUGH AND HARD

IT IS DIFFICULT to exaggerate the value of the ideal combination of **toughness and hardness** found only in MO-MAX. No other high speed steel surpasses MO-MAX in these important qualities. For 13 years MO-MAX has demonstrated its outstanding superiority and economy in every kind of cutting tool.

Check the other "plus" features which MO-MAX alone possesses. Order by brand name from one of the mills listed at the left.

Buyer's Guide to Brands of MO-MAX

"LMW" ..... Allegheny Ludlum Steel Corp.
"MOHICAN" ..... Atlas Steels Limited
"BETHLEHEM HM" .... Bethlehem Steel Co.
"MO-CUT" .... Brasburn Alloy Steel Corp.
"STAR MAX" .... Carpenter Steel Company
"MOLITE M-1" .... Columbia Tool Steel Co.
"REX T-MO" Crucible Steel Co. of America
"DI-MOL" ..... Henry Disston & Sons, Inc.
"HI-MO" .... Firth-Sterling Steel Company
"REX T-MO" ..... Halcomb Steel Company
"MOGUL" ..... Jessop Steel Company
"TATMO" ..... Latrobe Electric Steel Co.
..... St. Lawrence Alloys, Inc.
"S. T. M." ..... Simonds Saw & Steel Co.
"MO-TUNG" ..... Universal-Cyclops Steel Corporation
"8-N-2" ..... Vanadium-Alloys Steel Co.
"VUL-MO" ..... Vulcan Crucible Steel Co.

ONLY MO-MAX GIVES YOU *all* THESE ADVANTAGES

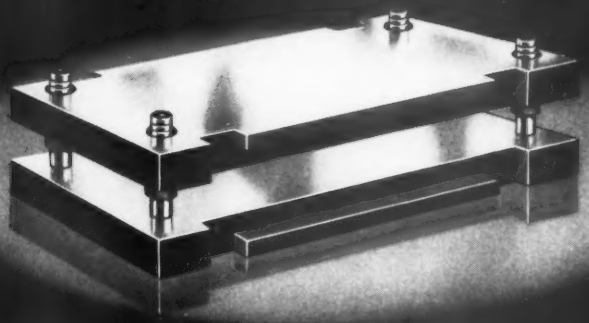
1. MO-MAX has superior cutting qualities. It is a happy combination of great toughness with high hardness.
2. The machinability of MO-MAX is unexcelled, particularly in grinding.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel. Thus for the same weight of high speed steel, 13 bars of MO-MAX are obtained as compared with 12 similar bars of an 18% tungsten steel.
4. In addition to the standard general-purpose composition of MO-MAX high speed steel, several special types have been developed for particular purposes. There are four with a high cobalt content, one high in vanadium and two that are especially suitable for hot die work.
5. MO-MAX was the first of the modern molybdenum high speed steels. For 13 years MO-MAX has demonstrated its superiority in cutting tools.

★ ★ ★

Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.

THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio

Finely Made Special Die Sets



We are well qualified by experience and well equipped mechanically to produce special die sets of the highest quality. Send us your prints or call the "Detroit" man in your area. We also supply standard die sets in all sizes, and all kinds of accessories.

CALL "DETROIT"

DETROIT	TR 2-5150
INDIANAPOLIS	LI 3884
MINNEAPOLIS	AT 5264
DAYTON	HE 3042
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SEATTLE	SE 2090
PORTLAND, ORE.	AT 1466
SAN FRANCISCO	MA 8532
BUFFALO	PA 9206
PHILADELPHIA	VIC 4084
ROCK ISLAND, ILL.	RI 743

DETROIT DIE SET CORPORATION

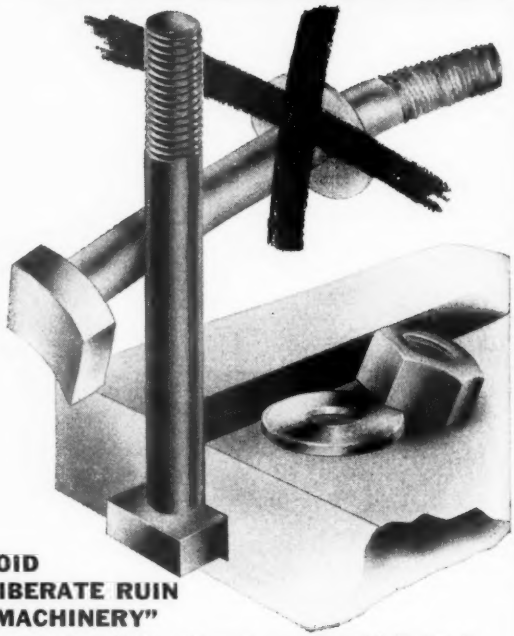
2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SETS ★

COPPER HEAD LAPS

. . . They pay for themselves in time saved! They work fast; they never wear out. The only wearing part is the replaceable sleeve. Sleeve adjustment feature permits maintaining correct lapping size till worn out and replaced with a new sleeve. Costly toolroom time is saved by using Boyar-Schultz Copper Head Laps. Available from stock in standard sizes ⅛" to 2½".

SPECIAL MACHINE BOLTS



"AVOID DELIBERATE RUIN OF MACHINERY"

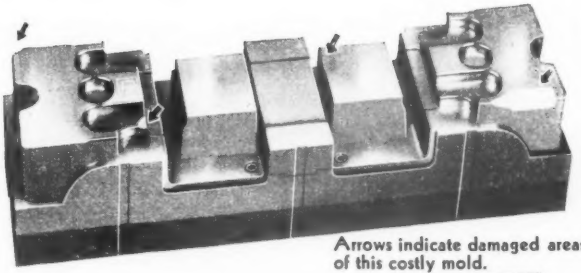
"Most metal working machinery is provided with T-slots in Tables for fastening work. In modern production these T-slots are completely finished by milling or planing; consequently every surface is finished smooth and square. But when machines are put in operation, any kind of hodge-podge bolt is used for fastening work. It does not take long to ruin T-slots with such bolts, and after that has happened, a most essential part of the machine is ruined. The cost of proper bolts is very small, and I hope that my observations expressed here will reach the men in authority to *avoid this deliberate ruin of American Machinery*."

Above is from a letter to Tool Engineer, January 1946.

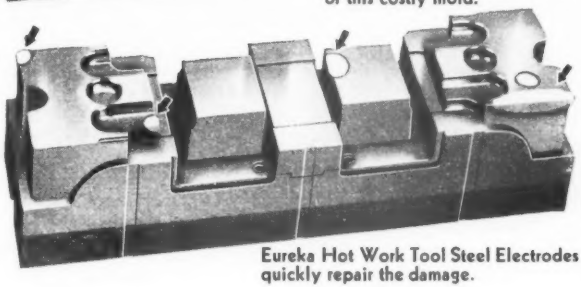
Boyar-Schultz Special T-Slot Bolts are made from upset forgings of heat treated alloy steels. Machined heads are square with bodies to present a clean flat surface to T-slot. Threads are carefully cut. For best results use Nuts and Washers made for use with Boyar-Schultz Special T-Slot Bolts.

BOYAR-SCHULTZ CORPORATION, 2112 Walnut St., CHICAGO 12

Plastic mold saved by welding!



Arrows indicate damaged areas of this costly mold.



Eureka Hot Work Tool Steel Electrodes quickly repair the damage.

■ The costly mold illustrated above was saved at a small fraction of its replacement cost and was back into operation with only a minimum delay. Eureka Hot Work Tool Steel Electrodes did the job. "Hard-as-welded" deposits have excellent hot-working, air hardening characteristics. Approximate hardness is 50-54 Rockwell C.

Weld deposits resist abrasion; are exceptionally tough; will withstand erosive action; alternate heating and cooling without fire checking; will not scale excessively. *There is a Eureka Tool & Die Welding Electrode to meet every need.*

EUREKA TOOL STEEL ELECTRODES — FOR EVERY TOOL STEEL NEED

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN

PRODUCTO PRODUCTO

PRODUCTO PRODUCTO

IT ISN'T WORTH BUYING ANY BUT THE *Best* DOWEL PINS

- With correct and uniform hardness.
- Ground to exact tolerances.
- Neatly packed and plainly marked for easy stocking.

Also a complete line of Die Sets and other Die Makers' Accessories are ready for immediate shipment from Producto branches and sales offices from coast to coast.

Get Catalog for details.

CALL

THE **PRODUCTO** MACHINE COMPANY
BRIDGEPORT 1, 990 HOUSATONIC AVE.

NEW YORK, 12
197 LAFAYETTE ST.

CLEVELAND, 14
5345 ST. CLAIR AVE.

INDIANAPOLIS, 2
635 FULTON ST.

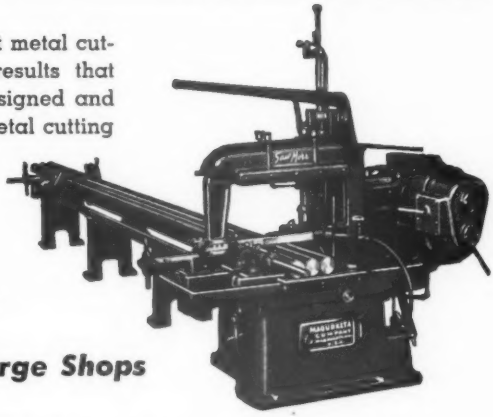
DETROIT, 11
3017 MEDBURY

LOS ANGELES, 21
2168 E. OLYMPIC BOULEVARD

IMMEDIATE DELIVERY

Saw More
METAL CUTTING MACHINES

Sawmore Machines set metal cutting standards with results that count, for they are designed and built to reduce your metal cutting costs . . . to save you time . . . to increase your production.



For Production, Steel Mills, Warehouses, Forge Shops

These outstanding features demonstrate Sawmore's superiority and leadership.

(a) Fully automatic! Set-up time 2-minutes, after which little or no attention is required.

(b) Saves floor space! Machines may be placed close to wall or aisle, for angular cuts are made by swiveling machine on base up to 45°.

(c) Precision accuracy! Sawmore's exclusive self-aligning bearings mean perfect rigidity, and alignment of the blade producing a much finer degree of cutting accuracy.

(d) Transmission! Four-speed, gear box transmission . . . with speeds approximately 65, 93, 120, 149 strokes per minute. Gears in constant mesh, operate in oil. Shifting by single lever control. Can be furnished with V-Belt.

Write for Details.

MAQUOKETA COMPANY

Maquoketa, Iowa

TOOLS for PRECISION PRODUCTION

The Modern Way to Mark Tools and Parts!

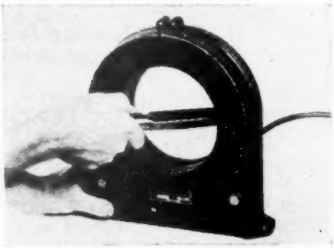
•ELECTRIC ETCHERS

Write on steel with electricity. This is a quality tool noted for its smooth etching action. Will stand up under rough shop use. Weighs only 22 lbs. Overall case dimensions—4¼" x 8" x 10". Standard 6-ft. cord and plug for operations from 110-volt 60-cycle A.C. current. Complete with new, patented offset stylus.

Clinging Particles Mean Dull Equipment!

•DEMAGNETIZERS

With this 6" "Through Type" Demagnetizer, merely pass the work or tool through the opening and remove to a distance of one or two feet before turning off the current. To speed up production, work may be dropped through by gravity. Operates from regular power lines. No moving parts. Other standard sizes from 4" x 24" to 18" x 24".



PROMPT DELIVERY. *Write for Literature.*

PRECISION PRODUCTION TOOLS

ACME TOOL COMPANY

96 WARREN STREET • NEW YORK 7, N. Y.

More Speed...
LONGER DRILL LIFE, with CONTINENTAL'S *New* DRILL CHIP BREAKER

Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads. ***Write for Continental Bulletin 28161 for sizes, complete specifications and 7 ways to profit by this new Continental product.***

With the Continental Drill Chip Breaker, the chip is broken at regular intervals. Small loose chips are easily carried up the flutes. Holes are straighter, rounder, and have better wall finish.

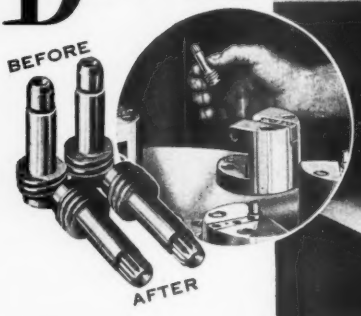
46—51

CONTINENTAL TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

1200 OAKMAN BOULEVARD • DETROIT 6, MICHIGAN

Broaching



—another application "made-to-order" for MULTIPRESS

Putting serrations in brass valve-stems proves MULTIPRESS efficiency

● "One-stroke" broaching of brass plumbing-fixture parts like those shown above is easy and economical when you use MULTIPRESS with a standard HydrOILic Index Table. The valve-stems are loaded into specially-built dies by the operator and are *automatically* moved to the broaching position, broached, and unloaded from the die.

This operation calls for a rather heavy "bite"—but you can *preregulate* the MULTIPRESS power load so that neither press nor tooling is endangered if the cutting die meets an off-dimension part. In addition, the pressure load is applied with *smooth uniform* velocity that avoids fractures and strains in the broached pieces, reduces tool wear and damage. Pressure, speed of operation, and stroke length are easily and quickly regulated.

And you are not limited to broaching operations alone!

Your basic MULTIPRESS is a complete, remarkably compact hydraulic press adaptable to *many* different jobs. The six-station index table offers extra speed and safety in feeding work into the press.

MULTIPRESS is built in 4, 6 and 8-ton capacities, with manual or automatic controls—a size and model for every job. Numerous standard accessories adapt it to a broad range of applications. Write for details, or recommendations on *your* requirements!

THE DENISON ENGINEERING CO.

DENISON EQUIPMENT for APPLIED HydrOILics

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Use a Chip Driver or Spiral Pointed Tap in a blind hole?

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The user of Winter Taps is entitled to this service — just one of the PLUS services offered by Winter Brothers. For the quick solution of your threading problems contact your local distributor handling Winter Taps. He has within his reach the complete resources and research facilities of the Winter Brothers Company.

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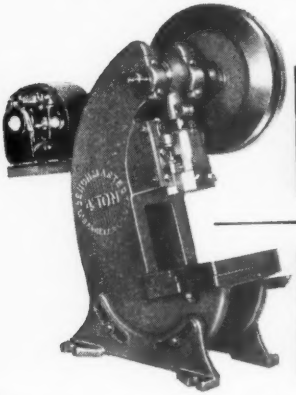
A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

Benchmaster's* Improved Model

4-TON CAPACITY BENCH PUNCH PRESS



*World's largest manufacturer of small presses.

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Light, compact and powerful, the improved, postwar Benchmaster 4-Ton Capacity Punch Press offers performance formerly found only in far larger models. Its unusual and exclusive features include a cradle base that allows the press to be inclined, a precision-ground shaft keyed by a press fit to a large eccentric to provide shock-absorbing bearing surface, bronze bushings at all wear points, a single trip action that may be made to repeat rapidly by removing a screw located in the collar, automatic knockout, an open back so that work may also be inserted from the front, a new-type floating motor mount which maintains proper tension of the V-belt, standardization of parts for quick, easy interchangeability and many other typical Benchmaster improvements.

For full information about this new Benchmaster Punch Press and other quality Benchmaster machine tools, write to Dept. TDJ-9.

SPECIFICATIONS:

Weight, 215 lbs.
Height, 27"
Die space, 5¾"
Center of bolster plate to frame, 3⅜"
Bolster plate, 6" x 8" x 1" with 2" hole in center
285 strokes per minute with 1725 R.P.M. electric motor
1" stroke standard
Other strokes up to 2" special

benchmaster MANUFACTURING COMPANY
2952 WEST PICO BOULEVARD
LOS ANGELES 6, CALIFORNIA

benchmaster tools

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—for users of High Speed Tool Steels

Now Ready!

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LATROBE DESEGATIZED HIGH SPEED STEELS

5

LATROBE ELECTRIC STEEL COMPANY • LATROBE, PENNSYLVANIA

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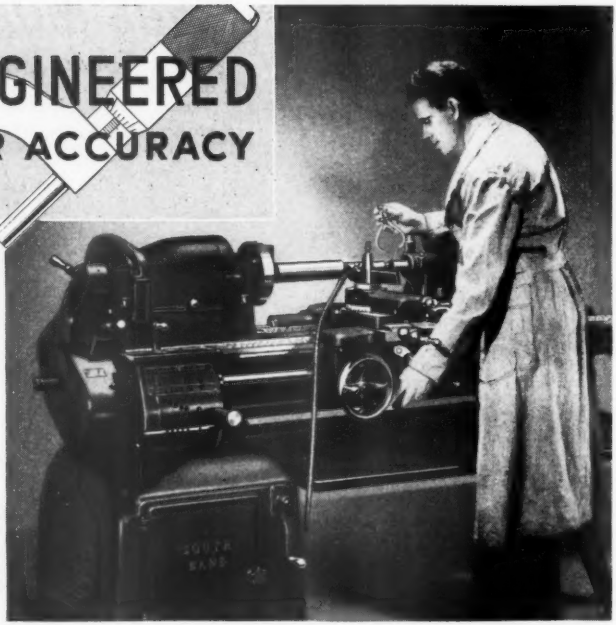

14-1/2" x 5' South Bend Quick Change Gear Lathe. Made with 5', 6', 7', and 8' bed lengths. Available also in Toolroom models.

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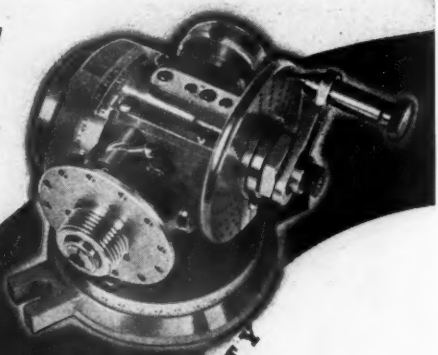

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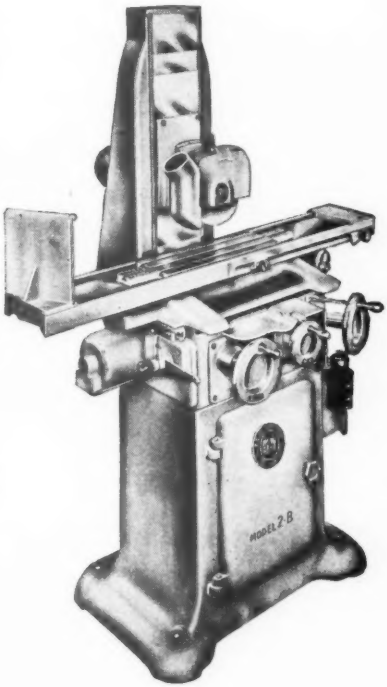

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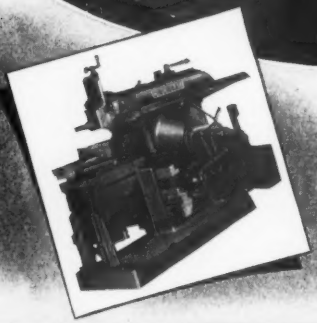

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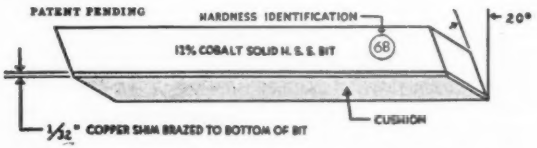

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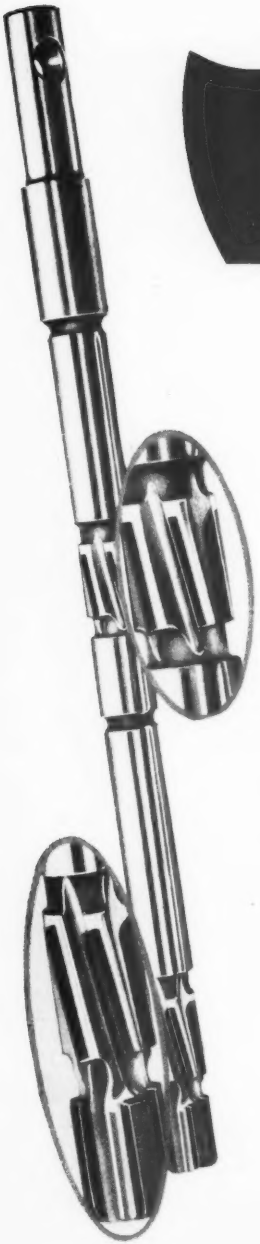

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by

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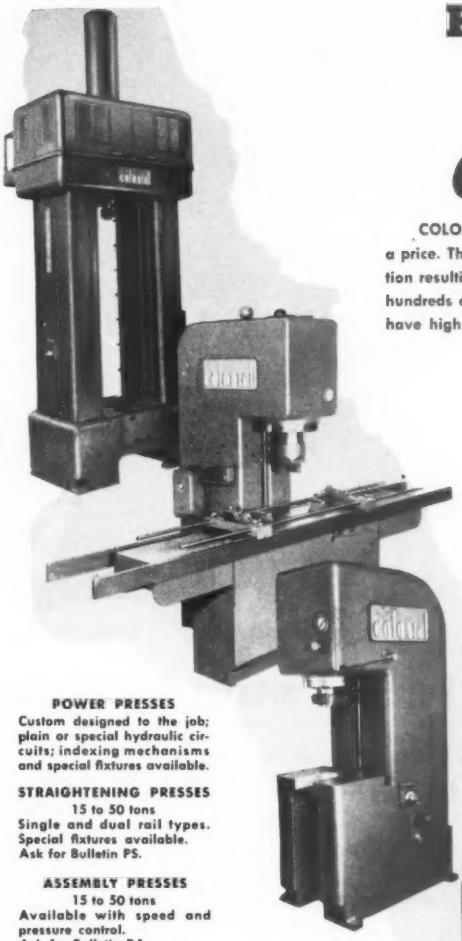

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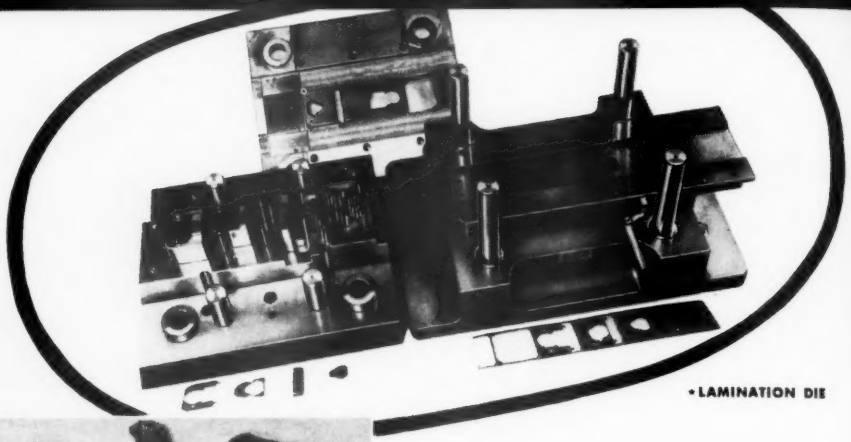

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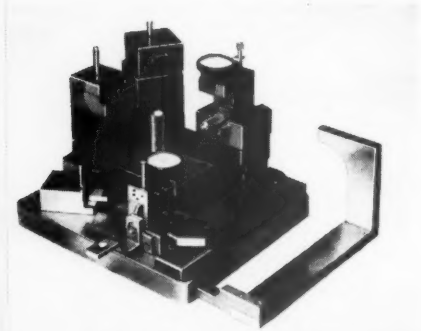

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R and L TURNING TOOL
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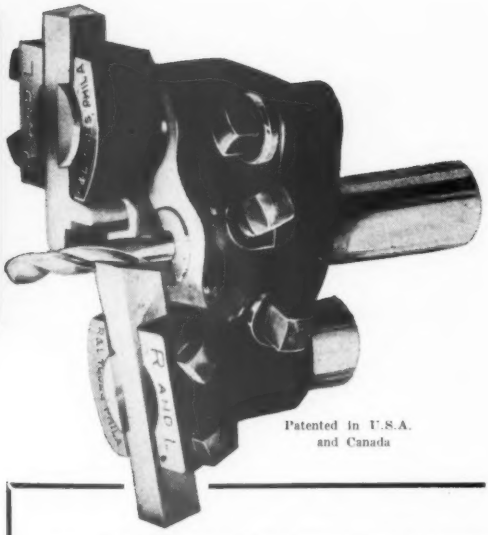

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- Knee Tool
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- Back Rest
- Floating Drill Holder
- Balanced Turning Tool

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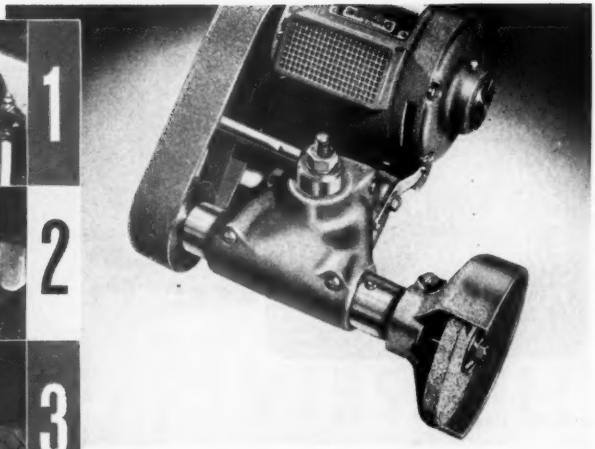
All these and many other features are shown by photographs in drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.



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If answers are affirmative, Sommer and Adams Productioneering can help you.

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Custom-Built EQUIPMENT FOR MANY PURPOSES

SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

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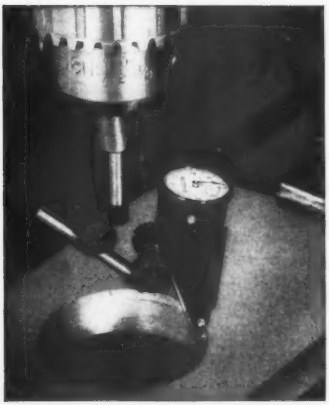
NEW PERPENDICULAR TESTMASTER

For Jig Borers and Similar Applications



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PRECISION MEASURING INSTRUMENTS

let's clean house again

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Wanted: all of the steel scrap that is lying dormant in industrial plants, warehouses, yards and out-of-the-way places.

We all remember vividly when the need for greater quantities of scrap was an urgent matter in the prosecution of the war. The scrap was collected and it was translated into terms of bullets, bombs and battleships.

Because we won the war we are being given a chance to win the peace. This must be accomplished not only at international conference tables but by raising the American standard of living and spreading it throughout the world. As the material needs of the peoples of the world are satisfied, the weapons of aggression are spiked. Steel is necessary to the things that satisfy material needs. Steel goes into them and helps to make them possible.

The country is faced again with a drastic shortage of steel scrap. The scrap supply has been so inadequate in recent weeks that 25 to 30 open hearths were idle August 1 for lack of scrap, as against 12 idle July 1 for the same reason. Meanwhile, during July, receipts of scrap by steel mills fell from an average of sixty percent to approximately forty percent of requirements.

If the flow of scrap remains at its present poor rate, inventories at mills will have vanished by the end of September. This will result in a further serious loss of production.

Scrap normally makes up fifty percent of the charge in open hearth furnaces from which by far comes the greatest proportion of all steel. The steel industry was able to increase its operating rate in July by using more pig iron in place of scrap, but the limit has just about been reached in this respect.

Here is a challenge to all steel users. To get more steel there must be more steel scrap collected and started off to the mills.

One industry-man-hour, nation wide, allocated to locating, toting and dumping on shipping platforms all the steel scrap that is within easy reach, would break this serious bottleneck and pay generous dividends on three counts: first, the satisfaction that comes of an essential job well done; second, the recovery of valuable floor space for productive purposes; and third, the steel scrap so vital to an increase in steel production would be on its way to the furnaces.

E. Willard Pennington

editor

Molding Powder Metallurgy Parts*

Manufacture of metal parts by the powder metallurgy method involves both loose powder flow and plastic flow during the compacting cycle. Mr. Seelig discusses and shows several press tool design considerations necessary to overcome certain production limitations imposed by metal powder behavior characteristics.

Many limitations are imposed upon powder metallurgy as a manufacturing method for parts by the raw material used, the sintering operation, and subsequent sizing and similar operations. However, the most frequently discussed limitations in powder metallurgy are based on the pressing or molding operation.

The following discussion will outline certain methods which have been developed in overcoming some of the restrictions on shapes and dimensions which can be handled by molding metal powders. It should be emphasized that many limitations are primarily economical in nature. This is important because of the fact that powder metallurgy is often used to produce parts in competition with other manufacturing methods. For example, it can be stated that there is no real technical limitation to the size of a product which can be made by powder metallurgy; but the high raw material cost, as well as the expense in operating large presses and furnaces, produces a trend toward diminishing returns with increase in size of parts.

Certain rules have been established concerning the design of shapes suitable for powder metallurgy[1]. Such considerations are usually based on the facts that (1) metal powders do not flow as a liquid; and (2) that compacted metal powders have restricted plastic flow. While the first property can be somewhat improved by selecting the proper particle shape and size in the powder, the second one is a more basic property of metals; hard metals will resist plastic flow more strongly than soft ones. But even soft ones under the effect of work hardening offer increased resistance to deformation with increased pressures.

**For courtesies extended in presenting this paper, grateful acknowledgment is made to Dr. Paul Schwarzkopf, Director of Research; Dr. C. G. Goetzel, Technical Director; and Dr. W. J. Leszynski, Editor, Powder Metallurgy Bulletin; all of American Electro Metal Corporation, 320 Yonkers Avenue, Yonkers 2, New York.* *See Page 158 for references.*

As a result of this behavior of metal powders, most commercial pressing operations can be described as follows: Powder is fed from the top of the die into the cavity by its own gravity. Pressure is applied in a vertical direction, sometimes by single action, often by double action. It is necessary to provide for lubrication in order to get reasonable die life and to improve the density distribution in a compact. It is usually necessary to use high pressures in comparison to other molding processes, such as plastic molding, die casting, etc. The compact has to be ejected from the die, usually through the cavity, including extra space provided for the filling of the powder; comparatively high pressures are usually required in order to remove the blanks from the dies. Each one of these steps offers a new challenge to the engineer who is concerned with the efficiency and control of these operations.

Feeding

Because of the fact that powder is fed in the manner described above, it is usually not possible to provide for overfill, such as is used in die casting, where risers and gates can be removed later on. Flashes such as occur in forging cannot be tolerated, inasmuch as powder metallurgy is a precision manufacturing process, many times not requiring any subsequent operations.

by Richard Paul Seelig

American Electro Metal Corporation

While it is customary to use manual powder feed for large or very intricate parts, such as, for instance, friction elements, the most widely used method in molding metal powders takes advantage of mechanically operated powder feed chutes which, in turn, are fed from hoppers or other suitable reservoirs. With this method, the die cavity is filled flush with metal powder, resulting in constant volume feeding. Occasionally, constant weight feeding has been accomplished by means of automatic high speed scales. This latter method is more accurate, but less speedy. Obviously, regardless of which method is used, mechanical operations are more accurate than manual ones. This is particularly true in that automatic powder feed eliminates the occasional stray parts which result from manual operation due to the human element. The above statements are based on tests whose results will be reported in a forthcoming paper[2].

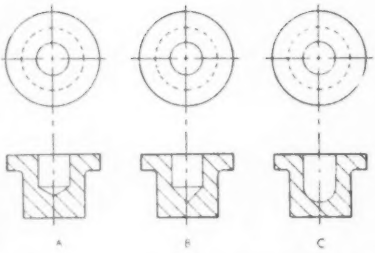


Fig. 1. Shown at A is a part containing a conventionally drilled blind hole. B and C show minor design alterations either of which permits production of the part by powder metallurgy.

It is necessary to provide for fill space above the actual working area of the die cavity. The transition between these two zones must be smooth. In some cases dies can be made in layers with fill space made from lower grade tool steel, particularly when very long pieces have to be molded. If a high piece has to be molded, the die cavity must be deep, the punches are long, the compacting and ejection strokes are long, and the operation is slow. To a certain extent this situation can be remedied by using powders having comparatively high apparent density. The application of vibrating mechanisms has also been applied successfully in such cases.

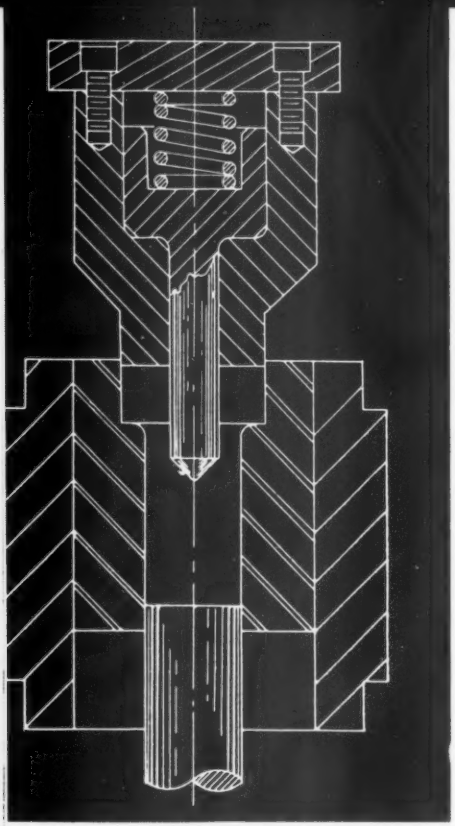


Fig. 2. A punch design for molding such a part as shown in Fig. 1. In action, the spring-loaded punch precedes the main punch into the cavity, resulting in uniform compacting of the powder to the desired shape.

Molding

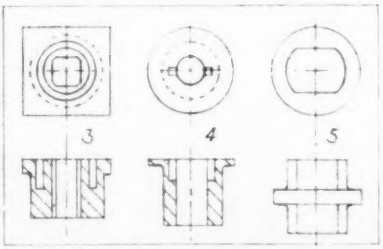
It would be highly desirable to be able to exert pressure sidewise as well as vertically in molding complicated shapes from metal powders. However, there are many difficulties in balancing the movements in the different directions and the construction of the dies and punches is very complicated. For this reason, single direction pressing is generally used in production. In order to compensate for the lack of side pressure, higher loads and double action movements are usually applied.

If the part to be made contains sectional changes beyond certain percentages, multiple punch movements are needed. This method is relatively simple, as long as all projections go in the same direction and the part is for all practical purposes flat on one side. If the part contains projections in both directions, it is necessary to close the die from all sides by means of the punches, without exerting any sizable pressure on the powder. Accurately timed punch movements can then produce enough shifting of the powder so that it is properly distributed b e f o r e compression. Thus, the usual requirement of equal density in each section of the part can be fulfilled within reasonable limits. A technique of this type has been described by C. G. Goetzel[2].

In the following, other examples of utilization of the limited amount of flow and loss of powder are illustrated.

Figure 1A shows a part containing a blind end hole, designed for a conventional drilling operation. Figures 1B and 1C are alternate designs suitable for powder metallurgy production. In either case the nominal hole depth is the same as in the original design. A slight taper, for instance .001" per inch, should be allowed if possible. Figure 2 illustrates a punch design suitable for molding parts of this type. The spring-

Fig. 3. To produce a part having an annular cavity as shown, the movable or spring-loaded upper punch member is in the form of a sleeve. Fig. 4. In this design, the recesses adjacent to the central bore are produced by a pair of tongues which act in advance of the main punch. Fig. 5. A common design feature is that of a projection or boss. To produce this without a special machine calls for die construction, as shown in Fig. 6.



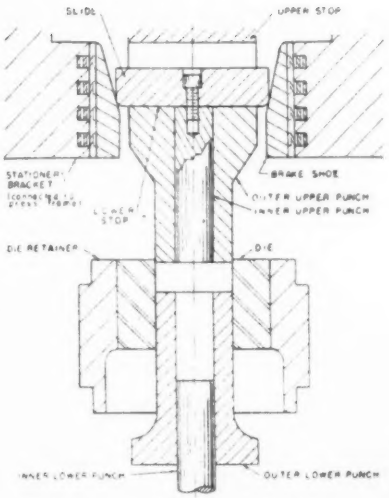


Fig. 6. A die design suitable for producing the part shown in Fig. 5. Here, the inner punch is held back by a brake, while the outer punch advances on into the die. Coincidental upward movement of the lower punch results in even distribution of the powder forming the two bosses.

loaded punch serves to penetrate the powder while it is still loose, before the punch has a chance to compact the powder. Although the stroke of the core and the load exerted by the spring may have to be adjusted in order to obtain proper distribution of density, it definitely has to come to a predetermined dead stop, which controls the depth of the hole in the finished compact.

If the distance by which the spring-loaded punch precedes the main punch into the cavity is too small, or if the force exerted by the spring (against the friction of the metal powder) is too low, excessive density will result at the blind end of the hole. The result may just be a non-uniform compact, resulting in uneven shrinkage and physical properties. However, a more undesirable effect will be inordinately high pressure transmitted to the movable core rod at the end of the cycle. If, on the other hand, the movable core stroke is made too

Fig. 7. Parts having curved surfaces require both loose powder flow and plastic flow during the compacting cycle. A spherical depression, as shown at A, necessitates a multiple punch having telescoping members. A design modification, B, permits the simplified tooling of Fig. 8.

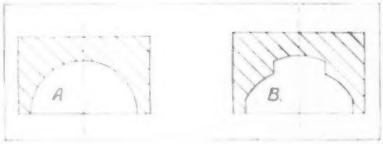


Fig. 8. The simplified punch design resulting from the design change of Fig. 7A to 7B. After the production of the compact to the shape of Fig. 7B, a subsequent coining operation produces the final desired shape of 7A.

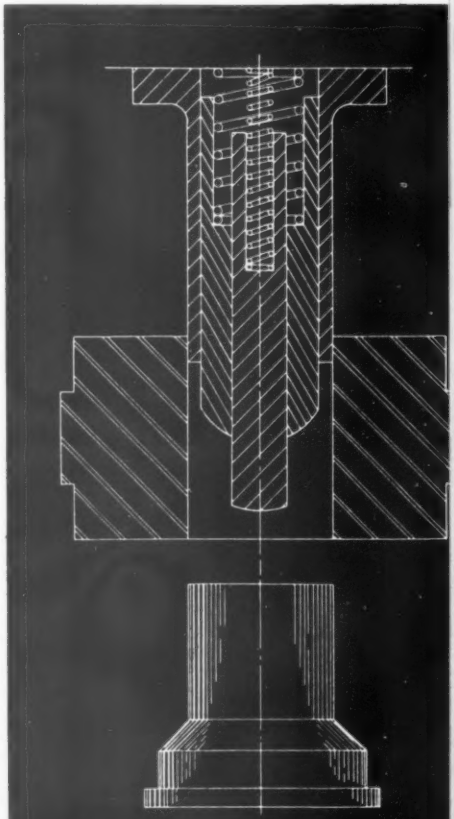
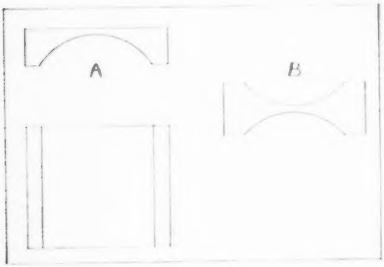


Fig. 9. A pole piece produced by molding a preform, B, having symmetrical distribution of powder, which can then be coined to the specified shape of A.



long, or the spring is too powerful, lack of density may result at the bottom. Moreover, the core may never reach its dead stop under these conditions, which means the depth of the hole will come out beyond the specified amount.

The same general principle outlined for the blind end hole can be applied to such parts as illustrated in Figures 3 and 4. In the one case, the movable upper punch member is a sleeve, while in the other it consists of a pair of tongues. The same considerations as outlined for the blind end hole apply, except that the expedient of streamlining the front ends of the penetrating punch inserts could not be used because of the functional requirements of these parts. Radii measuring as little as .015" on the corners were permissible.

Another design feature which can be taken care of without the use of special machines is projections or bosses as shown in Figure 5. A die design covering this type of shape is illustrated in Figure 6. The lower punch movements are conventional with the inner punch moving up first.

The upper punch is of special design. Inner and outer punch move down together being about flush. As soon as they enter the cavity, thus sealing it so that no powder can escape, a slide in the ram hits brake shoes which hold the inner punch back while the outer one enters into the die. At the same time the lower punch is moving upward and it can be seen how a fairly even distribution of the powder in the two hubs can be accomplished. When the abovementioned slide hits its upper stop, the inner punch partakes in the application of pressure to the compact.

After the compacting cycle is completed, the upper ram reverses. The brake holds the inner punch back while the outer punch is picked up first. This is a very desirable sequence. When the two punches are flush again, the slide reaches the lower stop and is thereby picked up away from the die so that the piece can be ejected.

Parts having curved surfaces are particularly difficult to handle because they require both flow in the loose powder as well as plastic flow during the compacting cycle. A part having a spherical depression is shown in Figure 7A. In order to mold such a part, a multiple punch having numerous telescoping movements can be used. In order to simplify the operation, an approximation of the spherical shape can be obtained in the molding operation, as shown in Figure 7B. In Figure 8, a punch design which would produce this type of shape is shown schematically.

TABLE 1[2]

Effect of Lubricants on Green Density of Compacts

Pressed at 30 t./s./i. from Nickel Powder

Material and Treatment	Percentage of Absolute Density
Nickel powder	66%
Nickel powder + ½% graphite	76%
Nickel powder + 4% graphite	78%
Nickel powder + 4½% silica flour	64%
Nickel powder + ½% stearic acid	75%
Nickel powder—die walls lubricated with stearic acid	76%
Nickel powder—die walls lubricated with colloidal graphite	74%
Nickel powder—die walls lubricated with stearic acid*	76%

*This compact was ⅛" high; all others 1"

For purposes of the illustration, the punches are shown spring loaded, although in actual operation individually controlled punch movements would probably be used to greater advantage. This type of molding operation makes the subsequent coining essential in order to produce the final desired shape.

A thoroughly practical approach to a similar problem involving the manufacture of a pole piece has been described by C. G. Goetzel[3]. Again the molding operation produces merely a preform and much of the work is left to one or more subsequent coining or sizing operations. The part and the preform are schematically illustrated in Figures 9A and 9B, respectively.

Lubrication

The use of suitable lubrication in molding metal powders is essential, not only in order to insure proper ejection and economical die life, but also to insure uniform density distribution throughout the part. It has been shown by experimental work that die wall friction is a much more important factor than interparticle friction[2].

In spite of these findings, it has been the practice to add lubricants to powder mixes rather than to apply the lubricant to the die walls. There are many good reasons for this technique. In some materials, the lubricant can be made to act as a binder, particularly if the powder is otherwise difficult to mold. In other cases, the lubricant helps create interconnecting porosity, such as in the case of self-lubricating bearings. On the other hand, for mechanical parts, foreign material may destroy the metallic continuity of the structure. However, it has been possible to develop lubricants which not only do not impair the strength, but may actually improve it. This was observed when using a highly pure iron powder upon which the lubricant had a very slight carburizing effect. However, in this, as in all other cases, the ductility is adversely affected. It seems desirable, therefore, to consider the use of a die wall lubricant for certain applications at least. Methods have been tried, but the amount of lubricant is usually difficult to control, the operation is retarded, and dimensional control is more difficult.

Methods other than lubrication for overcoming or decreasing die wall friction are also available. By selecting, e.g., a high chromium steel or by chromium-plating the cavity or by the use of sintered carbides, the coefficient of friction under high pressures can be reduced. Last, but not least, smooth surface finish is of the utmost importance.

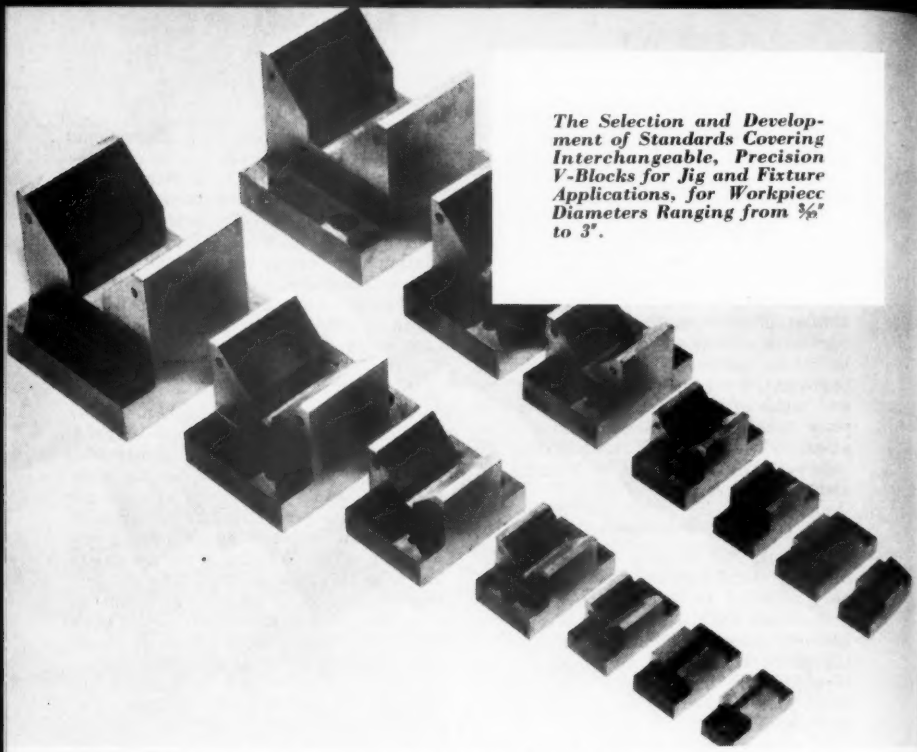
Ejection

As pointed out above, high pressures are needed in most molded powder products. The die has to be constructed in such a way, therefore, as to withstand the rapid application and release of these pressures. The die cavity must be a fully enclosed space during the pressing cycle. As long as the die cavity has to be left open at the top for feeding the powder, it is most convenient to eject the completed compact in the same direction. This method makes it necessary to provide for a powerful upward movement in the press. If possible, the die must be provided with a taper. Experience has shown that as little as .0005" per inch taper on the cavity side walls materially reduces the required ejection pressure and increases the life of the tools. Larger tapers should be selected if the tolerances permit. However, there is a limit to the amount of taper which can be used, because the upper punch enters the die against the taper and the clearance between the punch and the die wall in the working area must be accurately controlled. In tapered dies, therefore, this clearance is not only dependent on the accuracy of the die maker, but also upon the stroke of the punch into the die cavity.

In some cases split dies are used to advantage. Presses with side motions have been developed for this purpose. Many of the limitations imposed by the ejection operation could be eliminated by the use of such split molds. However, the speed of operation is greatly reduced, and would in many cases render the powder metallurgy product non-competitive.

In the conventional method of ejec-

(CONTINUED ON PAGE 158)



The Selection and Development of Standards Covering Interchangeable, Precision V-Blocks for Jig and Fixture Applications, for Workpiecc Diameters Ranging from 3/32" to 3".

A generous size range of fully interchangeable V-Blocks. Specifically designed for use as standardized parts in making up jigs and fixtures, they represent potential savings in dollars and manpower throughout a tooling program—engineering, toolmaking as well as production.

Jig and Fixture V-Blocks

In the past, manufacturers of appliances, business machines, farm equipment and other mechanisms containing shafts, were forced to use tool room made V-blocks for their jigs and fixtures, and this was done at a great expense. As it is our aim to set up standards on component parts of jigs and fixtures and those items that are most used in the manufacture of special tooling, we planned to develop a series of V-blocks that could be universally used.

Method of Developing Universal Standards

Our problem, of course, is to develop the standards in as few sizes as possible and still get the complete range from 1/32" to 3" diameter. We therefore commence development with the smallest size practical and work gradually to our largest size.

We start out with a 1/8" mean diameter

by A. H. Stanton
General Manager
Noble & Stanton, Inc.
Bedford, Ohio

V-block and lay this out twice scale. We sketch in a vertical center line and, by simply setting our compass point on the center line as the center, we find we can describe a $\frac{3}{32}$" diameter ($\frac{3}{16}$" scale size) tangent to our V-ways, with a top tangent to our diameter sufficiently above the top of the V-block. This demonstrates that our smallest diameter, $\frac{3}{32}$", can be considered practical. Although we could possibly use an even smaller diameter than $\frac{3}{32}$", we believe this is "the smallest practical," and right here we form the opinion that in each case, while the V-blocks will have a wider range than our working range, as shown by the layout of Figure 1, we shall keep our development within reasonable bounds, and our working range is our practical range.

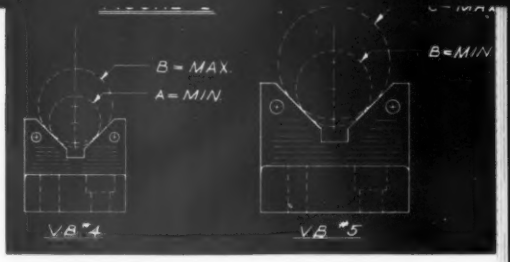


Fig. 1. Demonstrating the size progression of these standardized V-Blocks. Where "B" is developed as the maximum practical work accommodating diameter of one vee, it is thereby established as the minimum work accommodating diameter for the next larger V-Block.

We have thus established the $\frac{3}{32}$" diameter as our practical minimum and now we must find our practical maximum. We continue to enlarge our diameter using the same center line, always having our diameter tangent to the V-way layout. We finally find that a $\frac{3}{16}$" diameter will also fit our V-way and will not be too near the top edges of the V-way for adequate support. We now freeze the $\frac{3}{16}$" as the greatest practical capacity. Although we might have possibly used the $\frac{1}{8}$" size V-block for a $\frac{1}{4}$" shaft, it is hardly practical.

We now find that a $\frac{1}{8}$" standard V-block will accommodate a practical range of $\frac{3}{32}$" to $\frac{3}{16}$", therefore, $\frac{3}{16}$" will be our practical minimum for our next size V-block.

By using simple ratio, we find that a $\frac{1}{4}$" mean diameter V-block will have a $\frac{3}{16}$" to $\frac{3}{8}$" range. However, by actual projection, we find that a $\frac{13}{64}$" diameter also can be used in this V-way, without exceeding the limits of practicality.

Our range of sizes for our No. 2 V-block will be for a $\frac{3}{16}$" minimum and a $\frac{13}{64}$" maximum shaft. We continue with this method of projection for size No. 3 and our range is $\frac{13}{32}$" to $\frac{11}{16}$". We find that this size is very popular and will take $\frac{7}{16}$", $\frac{1}{2}$", $\frac{9}{16}$", $\frac{5}{8}$" and $\frac{11}{16}$" diameters and one which will have a wide range of application.

By using the same process of development, size No. 4 is shown to accommodate $\frac{11}{16}$", $\frac{3}{4}$", $\frac{13}{16}$", $\frac{7}{8}$", $\frac{15}{16}$" and 1" shafts. Size No. 5 will include 1" to 1½" diameters; size No. 6, 1½" to 2", and size No. 7 will cover the maximum range of from 2¼" to 3" diameters. So much for our layout of V-way sizes.

Our layout of the rectangular slot at the bottom of the V-way was designed to permit drill clearance when pin holes are to be drilled in the various size shafts, as well as milling cutter clearance, where the V-blocks are used in milling fixtures. In our V-block design, it is important that our rectangular slot is left soft, so that clearance holes may be drilled in their proper place, according to application.

We also had to be sure in the processing of these blocks, that our V-ways were center lined, and that our over-all dimensions were equal and identical so that in the event of tool breakdown in production, another fully interchangeable V-block could be placed in precisely the same position that the original V-block occupied.

It is recommended that in the design of fixtures using interchangeable V-blocks, a slot be milled the length of the fixture to receive the V-blocks. Thus perfect alignment is achieved without excessive assembly time. In this way, in the event of replacement, another V-block can be inserted immediately in place.

It may be of interest to know our processing of these standard V-blocks, as there are many operations and they are quite complicated.

Manufacturing Methods and Procedure

We will describe production of our VB-4, Figure 2, because this block is per-

haps the size most commonly used, as it has a range from $\frac{11}{16}$" to 1". In our first run we used SAE 1020 finished steel and depended upon carburizing and hardening for heat treatment. This process we found to be too expensive as we had to send the blocks twice to the heat treater because of having to remove stock after carburization and before heat treating. We therefore discontinued this procedure and have adopted induction hardening as our method. Thus we could harden the V-ways only, leaving soft our clearance slot for drilling and our dowel pin holes for reaming. This necessitated the use of a high carbon steel, but we believe that the savings in processing are worth the difference in machinability.

While we process V-blocks in quantities of 50 to 300 pairs and are completely tooled up for these quantities, I am going to try to describe the processing of the small quantity to suit the average small tool room needs for a short period.

For our VB-4 block we cut a piece of 1¼" x 1⅜" SAE 1045 cold rolled steel 24⅜" long. We will find this steel fairly square, and after we file the burrs off we can then clamp this bar exactly parallel in a set of previously aligned V-blocks on our horizontal milling machine. We use a milling saw and cut to sufficient depth, the entire length of the bar, leaving from fifteen to twenty thousandths stock for grinding. We then remove the bar, turn it end for end, and see that our milling cutter is in the exact position necessary to cut the opposite side of the bar.

Our next operation will be milling the ¼" wide slot at the bottom of the V, and this only requires simple alignment and clamping.

We then saw this bar into 2⅜" lengths, and we find we have enough for 5 pairs of V-blocks. In our own shop we use holding fixtures to straddle mill the 2¼" over-all lengths and to straddle mill the end flanges to a 1¼" length of V-way. However, these operations can be done satisfactorily by using a side mill and a simple vise.

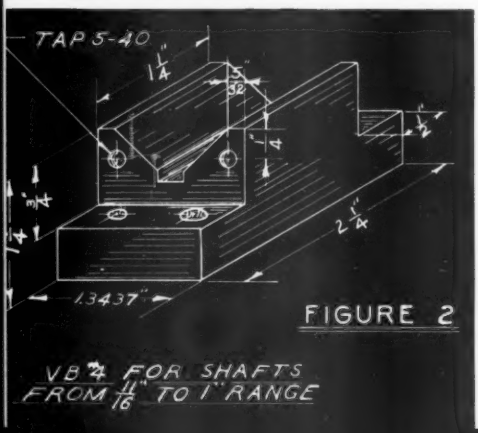
We now double check our V-way and remove any surplus stock. We drill two size "D" (.246") holes for dowel pins and two $\frac{1}{4}$" holes which we counterbore for socket head screws. We then lay out for two No. 38 holes, drill and tap for No. 5-40 thread. These will be ⅜" deep. These holes will be used when and if a stop at the end of the V-block is necessary.

We then file off the burrs and break all corners. The blocks are now ready for induction hardening of the V-ways only. Upon their return from the hardener, we Rockwell check the V-ways. We then Blanchard grind the top of the blocks to clean up and next Blanchard grind the bottom to clean up. We then change to the Hammond or B & S surface grinder and grind one side square with the bottom and .680" from the center line of the V to our grinding surface.

Using this as a working surface, we return to the Blanchard and grind the opposite side to .6718" from the center line of the V and next Blanchard grind our first side to give a finished total width of 1.3437". We now go back to our surface grinder and grind the two Vs, first one side and then the other in magnetic V-blocks.

We now have ten finished interchangeable V-blocks in stock and great savings have been realized, when we consider the high cost of making one pair at a time in the tool room.

Fig. 2. Step-by-step, V-Block production operations are detailed in the text. The close control effected by the most modern induction hardening setups permits hardening of the work supporting faces of the vee, but leaves soft the precision centered slot and mounting hole areas for producing drill and cutter clearances and for reaming.



The Care and Servicing Of Carbide Mandrels

by A. E. Glen
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Detroit, Michigan

The ever increasing use of carbide dies and mandrels for the production of tubing made from plain, alloy and stainless steels, brass, bronze, aluminum, cupro-nickel, and aluminum bronze has brought with it a need for a wider understanding of the importance of correctly using and servicing these tools. The following hints on use and care of carbide mandrels have been compiled in the interest of increasing mandrel service life, obtaining better inside finish on tubing, maintaining closer tolerances on long runs, providing more continuous operation, and decreasing rejections.

A Carboloy mandrel is a precision tool. To obtain maximum results with it, it should be accorded the same care and consideration given any other precision tool. Proper use and servicing, however, are no more difficult or complicated than that of any other precision tool employed in production work.

Component parts of a Carboloy mandrel, Figure 1, are (a) the cemented carbide nib which may be either straight or tapered, mounted on (b) a hardened steel stud and drawn up tight to a straight steel shank (c). These mandrels are supplied finished and ready for use in the tube mill; or may be made up by obtaining finish ground, semi-finished, or rough carbide nibs for finishing and assembling as required.

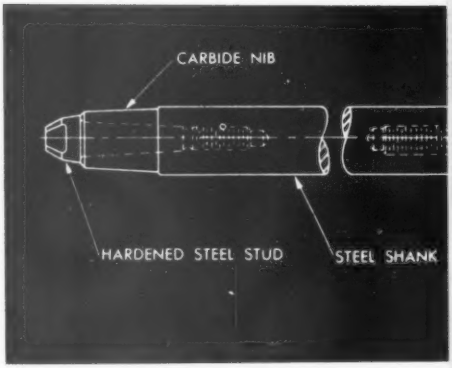


Fig. 1—Component parts of a Carboloy mandrel are a carbide nib mounted on a hardened steel stud and drawn up tight to a straight steel shank.

An important factor in carbide mandrel usage is that all tubes should be so pointed that the reduced portion of the tube, Figure 2, blends into the larger diameter with a *radius* rather than an *angle*. This tends to lessen the shock on the carbide nib and makes for longer life of the equipment. All hot pointed stock should be pickled to remove the abrasive crust of scale formed by heating. The pointed end of the tube should be open. This eliminates forma-

haps the size most commonly used, as it has a range from 1/8" to 1". In our first run we used SAE 1020 finished steel and depended upon carburizing and hardening for heat treatment. This process we found to be too expensive as we had to send the blocks twice to the heat treater because of having to remove stock after carburization and before heat treating. We therefore discontinued this procedure and have adopted induction hardening as our method. Thus we could harden the V-ways only, leaving soft our clearance slot for drilling and our dowel pin holes for reaming. This necessitated the use of a high carbon steel, but we believe that the savings in processing are worth the difference in machinability.

While we process V-blocks in quantities of 50 to 300 pairs and are completely tooled up for these quantities, I am going to try to describe the processing of the small quantity to suit the average small tool room needs for a short period.

For our VB-4 block we cut a piece of 1¼" x 1⅜" SAE 1045 cold rolled steel 2⅜" long. We will find this steel fairly square, and after we file the burrs off we can then clamp this bar exactly parallel in a set of previously aligned V-blocks on our horizontal milling machine. We use a milling saw and cut to sufficient depth, the entire length of the bar, leaving from fifteen to twenty thousandths stock for grinding. We then remove the bar, turn it end for end, and see that our milling cutter is in the exact position necessary to cut the opposite side of the bar.

Our next operation will be milling the ¼" wide slot at the bottom of the V, and this only requires simple alignment and clamping.

We then saw this bar into 2⅜" lengths, and we find we have enough for 5 pairs of V-blocks. In our own shop we use holding fixtures to straddle mill the 2¼" over-all lengths and to straddle mill the end flanges to a 1¼" length of V-way. However, these operations can be done satisfactorily by using a side mill and a simple vise.

We now double check our V-way and remove any surplus stock. We drill two size "D" (.246") holes for dowel pins and two 7/16" holes which we counterbore for socket head screws. We then lay out for two No. 38 holes, drill and tap for No. 5-40 thread. These will be ⅜" deep. These holes will be used when and if a stop at the end of the V-block is necessary.

We then file off the burrs and break all corners. The blocks are now ready for induction hardening of the V-ways only. Upon their return from the hardener, we Rockwell check the V-ways. We then Blanchard grind the top of the blocks to clean up and next Blanchard grind the bottom to clean up. We then change to the Hammond or B & S surface grinder and grind one side square with the bottom and .680" from the center line of the V to our grinding surface.

Using this as a working surface, we return to the Blanchard and grind the opposite side to .6718" from the center line of the V and next Blanchard grind our first side to give a finished total width of 1.3437". We now go back to our surface grinder and grind the two Vs, first one side and then the other in magnetic V-blocks.

We now have ten finished interchangeable V-blocks in stock and great savings have been realized, when we consider the high cost of making one pair at a time in the tool room.

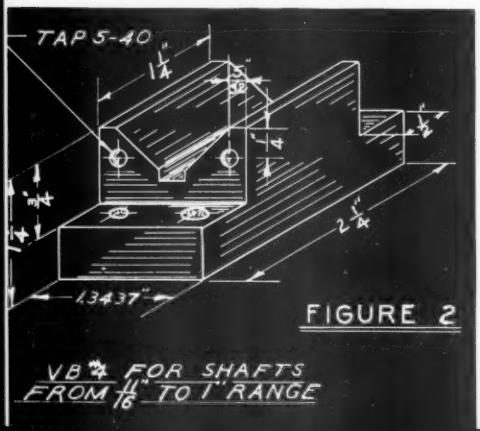


Fig. 2. Step-by-step, 1-Block production operations are detailed in the text. The close control effected by the most modern induction hardening setups permits hardening of the work supporting faces of the vee, but leaves soft the precision centered slot and mounting hole areas for producing drill and cutter clearances and for reaming.

The Care and Servicing Of Carbide Mandrels

by A. E. Glen
Carboloy Company, Inc.
Detroit, Michigan

The ever increasing use of carbide dies and mandrels for the production of tubing made from plain, alloy and stainless steels, brass, bronze, aluminum, cupro-nickel, and aluminum bronze has brought with it a need for a wider understanding of the importance of correctly using and servicing these tools. The following hints on use and care of carbide mandrels have been compiled in the interest of increasing mandrel service life, obtaining better inside finish on tubing, maintaining closer tolerances on long runs, providing more continuous operation, and decreasing rejections.

A Carboloy mandrel is a precision tool. To obtain maximum results with it, it should be accorded the same care and consideration given any other precision tool. Proper use and servicing, however, are no more difficult or complicated than that of any other precision tool employed in production work.

Component parts of a Carboloy mandrel, Figure 1, are (a) the cemented carbide nib which may be either straight or tapered, mounted on (b) a hardened steel stud and drawn up tight to a straight steel shank (c). These mandrels are supplied finished and ready for use in the tube mill; or may be made up by obtaining finish ground, semi-finished, or rough carbide nibs for finishing and assembling as required.

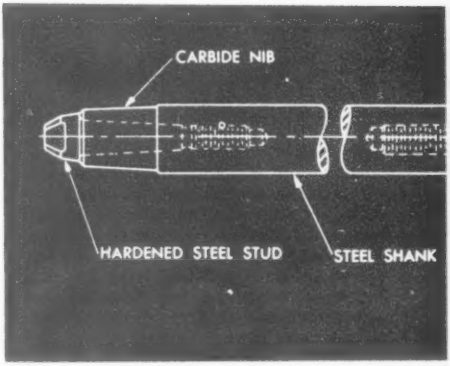
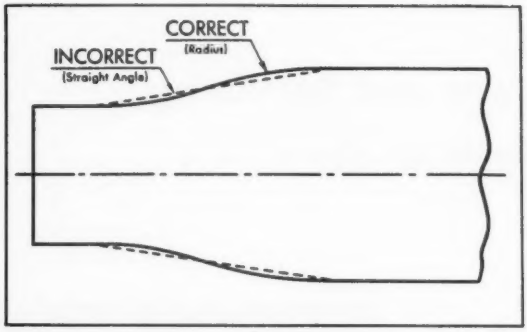


Fig. 1 Component parts of a Carboloy mandrel are a carbide nib mounted on a hardened steel stud and drawn up tight to a straight steel shank.

An important factor in carbide mandrel usage is that all tubes should be so pointed that the reduced portion of the tube, Figure 2, blends into the larger diameter with a *radius* rather than an *angle*. This tends to lessen the shock on the carbide nib and makes for longer life of the equipment. All hot pointed stock should be pickled to remove the abrasive crust of scale formed by heating. The pointed end of the tube should be open. This eliminates forma-



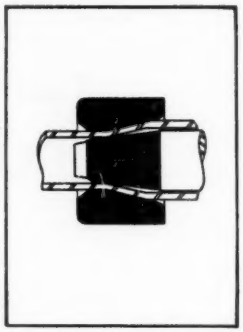


Fig. 2—Pointed end of tube must be opened to permit a free flow of both acid and lubricant.
Fig. 3—Set tapered mandrel into die just enough for correct size.

tion of air pockets and thus permits a free flow of acid and lubricant over the entire inside surface of the tube.

Proper annealing of tubes is desirable to obtain optimum economies and maximum mandrel life. Best practice is to anneal tubes, if possible, *after each pass.* Improper annealing will invariably result in tubes that are too hard, spotty, or otherwise below standard. Such tubes have a tendency to chatter while being drawn. Chatter eventually causes pickup and scratches on interior of the tubing and also causes excessive heating of the mandrel. Excessive heating sets up strains in the nib which in time will cause small surface cracks. These may lead to complete failure of the mandrel. Thus, mandrel life can be lengthened, costs lowered, and more continuous draw bench operation obtained by the proper annealing of the tubes.

Carelessness during pickling and cleaning of tubes can cause scratches on tubing which may put excessive pressure on the mandrel, resulting in failure of the tool. Even one bad tube can materially decrease the service life of a carbide mandrel.

Tubes should have a light etch rather than a smooth surface on the interior. An etched surface will hold the lubricant better than a smooth surface, giving a more uniform drawing surface which reduces friction and eliminates scratching and pickup. Etching too deeply causes "acid burn" which may harm the mandrel, whether it is of carbide, chrome plated steel, etc.

Correct lubrication is extremely important in tube drawing. Improper lubrication results in metal-to-metal contact which creates excessive heat. If allowed to continue, this heat will eventually cause the lubricant to break down. When that happens, the carbide mandrel picks up and starts scratching the tubing. When pickup occurs, the amount of heat generated is frequently enough to turn the mandrel blue. The heat may also cause surface cracks to appear on the carbide nib. Their appearance is usually followed by small particles of carbide falling from the nib and eventually by complete failure of the mandrel.

To lubricate, place back end of tube in lubricant tank first. Gradually submerge entire tube. If done correctly, this expels all air and permits complete coverage of lubricant over interior surface of tube. If pointed end of tube is closed, cut it off and re-point tube, to provide an opening so the air can escape.

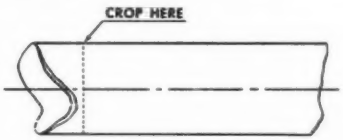
Correct draw bench alignment is important in obtaining optimum benefits from carbide mandrels as well as other types. Have the die lined up accurately with the grip-and-pull carriage in order to draw the tube on-size and straight. Improper alignment produces bowed and off-size tubing. The mandrel rod must be properly aligned and in line with the die.

An off-center mandrel rod puts unnecessary strains on the mandrel, especially when back end of tube is passing over the mandrel.

When setting up a carbide mandrel, it is important that the mandrel be set in the correct position in relation to the die. Slightly different practices are required for tapered and straight mandrels, as shown in Figures 3 and 4.

When setting a tapered mandrel, adjust it just far enough into the die to produce the correct size, Figure 3. The setup should be checked to make sure that the tubing does not start to reduce

Fig. 5—Trim back end of tube when excessive "scalloping" develops.



on the steel shank in back of the carbide nib. If this occurs, wear marks will show after drawing. Experience to date shows that tapered mandrels are more efficient than straight ones. Ample clearance of the mandrel's point is automatically provided by the taper after the inside diameter of the tubing has been sized. Area of contact is also reduced with tapered mandrels. This helps maintain efficient lubrication.

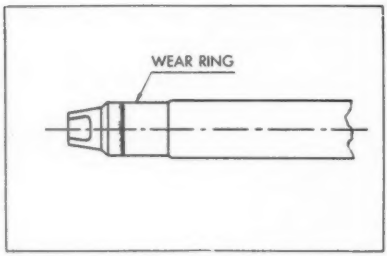


Fig. 6—Service carbide mandrels as soon as rings and wear marks are visible.

The straight mandrel should be set into the die so that the end of the mandrel's chamfer extends *slightly past* the bearing, Figure 4. When a straight mandrel has been properly set, its surface will show evidence of contact with the tube at a point from $\frac{1}{16}$" to $\frac{3}{8}$" away from end of chamfer on the mandrel. If a straight mandrel is extended too far through the die, too much of the mandrel's carbide surface will be in contact with the tube's interior. This condition may cause pickup due to unnecessary friction and strains on the mandrel. However, if the mandrel is not set far enough into the tube, it is virtually impossible to get the tube to start.

It is well to make certain the tube does not strike the mandrel's end too forcibly when the tube is being pulled over the mandrel rod prior to drawing. Constant pounding on the mandrel's end may cause the carbide to chip off the front end,

Fig. 4—Set straight Carboloy mandrel into die so that end of chamfer extends just slightly past the bearing.

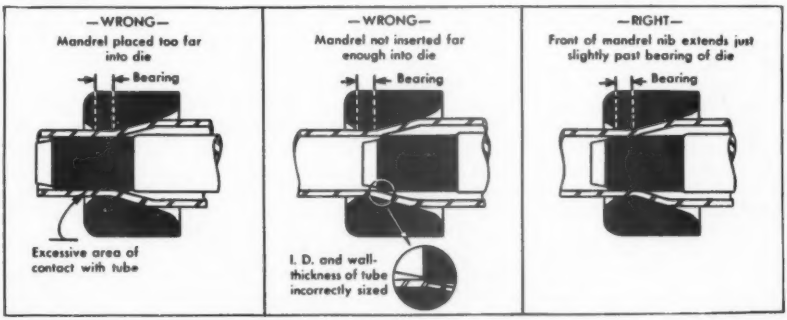
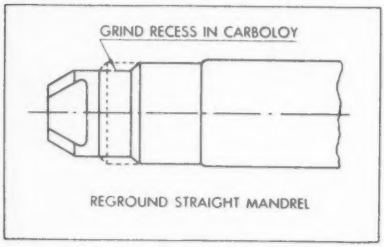

—WRONG—
Mandrel placed too far into die
Bearing
Excessive area of contact with tube
—WRONG—
Mandrel not inserted far enough into die
Bearing
I. D. and wall-thickness of tube incorrectly sized
—RIGHT—
Front of mandrel nib extends just slightly past bearing of die
Bearing

Fig. 7—When straight mandrel wears undersize, grind recess in nib as shown.



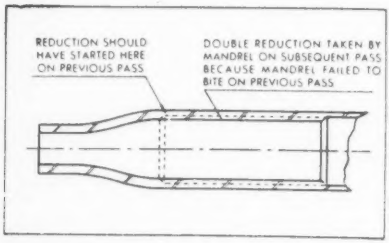

REDUCTION SHOULD HAVE STARTED HERE ON PREVIOUS PASS
DOUBLE REDUCTION TAKEN BY MANDREL ON SUBSEQUENT PASS BECAUSE MANDREL FAILED TO BITE ON PREVIOUS PASS

Fig. 8—To avoid this condition, maintain a sharp edged chamfer on front end of mandrel nib.

offering a starting point for longitudinal cracks in the nib.

Tubing should always be trimmed regularly. After a tube has been drawn through several passes, the elongation will cause a "scalloped" back end to form on the tube, Figure 5. Quite a bit of stress is set up when such a tube is drawn over the mandrel. Moreover, the mandrel is twisted at the instant the "scalloped" end of the tube leaves the nib. Therefore, if the back end of the tube is regularly trimmed before "scalloping" becomes too pronounced, the life of the carbide mandrel will be materially lengthened.

Greater efficiency is obtained from Carboloy mandrels by servicing at predetermined and regular intervals, rather than waiting until the mandrels "appear" to need servicing. Regular servicing gives better tubing, reduces operating costs, and results in longer over-all mandrel life.

After considerable use, it will be noticed that slight "rings" and wear marks, Figure 6, will develop on the carbide nib of the mandrel at the point where tube reduction starts. If the mandrel is serviced as soon as these wear rings become visible, the rings can be removed by lapping and polishing.

If prompt servicing is neglected, deep wear rings will eventually form in the nib. Such rings tend to remove all lubricant from the tubing. When this happens, the tubing will pick up and scratch. Eventually, small particles of the carbide will pull out, leading finally to complete breakdown of the tool.

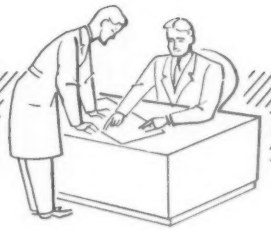
A straight type mandrel which has worn undersize may be salvaged by resetting the mandrel further into the die. Before doing so, however, it is important that a recess be ground into the mandrel nib, Figure 7, so as to avoid too great an area of contact with the tube.

When drawing steel tubing, a sharp edged chamfer should be maintained on the mandrel nib's front end. If this chamfer becomes rounded over, the mandrel will not immediately "bite" into the tubing as it should. If this happens, no reduction of tubing wall thickness occurs for some 6" to 8" during the first draw. This means that the mandrel must take a double reduction at the start of the next drawing operation, Figure 8. The sudden jerk that occurs when point of normal reduction is reached tends to put excessive strain on the carbide mandrel.

In case of a double reduction, the tube end should be cut off beyond the area of double reduction and then re-pointed. A sharp chamfer may be maintained on the mandrel nib's front end by grinding it with a 100 grit diamond wheel, or by turning it with a diamond boring tool in a lathe.

These simple precautions will greatly increase the effectiveness of carbide mandrels in tube mills. Neglecting these factors may result in sacrificing a considerable portion of the better inside finish on tubing, closer tolerances on long runs, higher drawing speeds, increased footage per day, and the longer mandrel life, all of which are made possible by the correct use and servicing of carbide mandrels and dies.

A Complete Quality Control Program*



by Joseph Manuele
Director of Quality Control
Westinghouse Electric Corporation

Quality control implies the control of quality at some predetermined level as contrasted to inspection, which is a post-mortem operation. Any attempt to control quality, automatically includes a decision as to the quality level. While perfection is desirable, it is not possible to attain. Even though the attainment of this perfection were possible from a manufacturing point of view, it would not be desirable, in all cases, to do so; in many instances costs would be prohibitive.

Therefore, at the very outset, a desirable quality level must be established—shall it be ½% defectives, 2% defectives, or 5% defectives? This level of quality must be determined after due consideration of the relative costs of maintaining a higher level of quality as compared to the losses which might be incurred from a lower level. The factors to be considered in making this decision will be different in different cases.

Having made this analysis and having determined on proper levels of quality for the different items being made, it will be found that some operations result in products which are satisfactory, or which meet the quality standard established. Obviously, in the interest of lowest cost, there is no need to put controls on such operations. However, there are operations which result in a higher level of percent defectives than is desirable. The problem, then, is to determine, factually, which of the operations are satisfactory and on which operations it is necessary to establish controls. We say "determine factually" because many factory executives "know" which operations are out of control, but they have no records to substantiate this "knowing". In many cases, records would present a different picture. The first step, therefore, is to collect some accurate records. A simple single-sampling plan will accomplish this.

**A paper delivered before the Midwest Quality Control Conference, Chicago, March 5, 1946. Presented here by courtesy of Martin A. Brumbaugh, Editor "Industrial Quality Control" and the author.*

SAMPLING TABLE 2—1% DEFECTIVE ALLOWABLE

1. Lot Size	2. Sample Size	3. No. Defective Allowed in Sample	4. Risk of Accepting a Lot 3% Defective
200- 300	115	1	.13
301- 500	170	2	.11
501- 1000	220	3	.10
1001- 2000	230	3	.09
2001- 3000	240	3	.08
3001- 4000	290	4	.05
4001- 5000	300	4	.05
5001- 7000	345	5	.05
7001- 10000	395	6	.04
10001- 20000	460	7	.03
20001- 50000	540	8	.02
50001-100000	640	9	.01

SIMPLIFIED SAMPLING TABLES—PLAN "A"

When parts are received, or are produced, in quantities it is always desirable to determine the quality of a lot of such parts. This can be done by inspecting the parts 100%, which is relatively a slow and expensive operation, or by scientific sampling of the parts. The tables forming a part of this System Letter are designed for the latter purpose.

The tables have been calculated to pass lots according to different percentages of defective parts allowed "in the long run". They also show a degree of risk of accepting individual lots containing a percentage defective higher than that desirable.

As an example, let us suppose that we have a lot of 1325 parts of a particular drawing and item. The first decision that we must make is *what percentage of defective parts we will accept in the long run.* Let us assume that we do not want more than 1% defective parts. Then we refer to Sampling Table 2, 1% Defective Allowable.

Since we have 1325 parts, reference to the table will show that we must take a sample of 230 parts. We proceed to inspect these 230 parts very carefully, and if we find *three defective parts or less* we will accept the entire lot. If we find four or more defective parts, we reject the lot, and we will either detail the lot or return it to the supplier.

This procedure assures us *that in the long run* the number of defective parts in accepted lots will not exceed 1%. However, we note in the column headed "Risk of Accepting Lots 3% Defective" there is the figure .09 opposite sample size 230. This means that we might accept a *single lot* which contains as much as *3% defective* parts about 9% of the time, or about one time in eleven.

Use of these tables will reduce inspection costs and assure better quality of parts by putting the inspection where it belongs: on lots containing a high percentage of defective parts.

In order to make the most efficient use of these tables, the results of inspection should be recorded on a suitable form. A suggested form is attached to and forms a part of this Systems Letter.

Fig. 1. Simplified Sampling Table 2, Plan "A". Quality Control Systems Letter No. 45.2.

To establish a quality control program for a complete plant or department, it is necessary that provision be made for all contingencies and that the program be designed to give control over all items or products manufactured in that plant. The best procedure for determining this is to sample all lots produced in the plant. For this purpose, it is necessary that a simple though complete sampling plan be designed. The sampling plan must have two features: (1) It must provide for different levels of quality, depending on the particular quality level desired in any item. Convenient levels of quality for parts or sub-assemblies are ½%, 1%, 2% and 5% defectives allowable. (2) As a second characteristic a sampling plan must be understandable by the inspector who is to use it. This means that the instructions for use of the plan must be reduced to barest fundamentals.

The sampling plan may be issued to the inspectors in the form of a "System Letter" as shown in Figure 1. It will be noted that the information is given in the form of tables (only one of which appears in Figure 1) and not in the form of curves or charts. Inspectors with limited education, especially female inspectors, can use tables more readily than charts.

As an adjunct to the proper functioning of a sampling plan, it is necessary that the results of sampling be recorded systematically and in a uniform manner, preferably on a printed card, as shown in Figure 2.

The sampling plan must provide for definite action to be taken on each and every lot sampled. The sampling plan must allow for passing nearly all satisfactory lots. The plan must also provide for action on the rejected lots. The first action to be taken on rejected lots is detail inspection. The results of this detail inspection must be recorded on the record card showing the number of pieces detailed, the number of pieces defective, and the percent defective. The card should also show by means of notes the nature of these defects.

The second action which must be taken on all rejected lots is to place controls on the process so that the quality level can be raised to the desired value. There are two convenient methods for controlling the quality of products.

For short runs and those operations not involving tool wear or close control of quality characteristics, first piece and patrol inspection has been found to be economical and effective. Essentially, first piece inspection involves the check-

DWG. NO. _____ ITEM NO. _____ STYLE NO. _____

NAME OF PART _____

PART USED WITH _____ USE SAMPLING PLAN A B

MANUFACTURING SECT. _____ CUSTOMER _____

DATE	LOT SIZE	SAMPLE SIZE	NO. DEFECTS	DISPOSITION OF LOT		RESULTS OF DETAILING		% DEF.	NOTES ON BACK
				ACCEPT	REJECT	NO. DETAILED	NO. DEF.		

Fig. 2. Form for recording all sampling and detailing results.

A NEW *Grinding Machine*

CINCINNATI

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THE FILMATIC 4" PLAIN HYDRAULIC

● This new member of the CINCINNATI line of FILMATIC bearing grinding machines is designed for precision traverse grinding operations on small work. It swings 4" diameter over the table, and is built in 12" and 18" between-center lengths. The machine has many new and exclusive features such as: FILMATIC grinding wheel spindle bearings; hydraulic table traverse, infinitely variable from 3 to 280 inches per minute; accuracy of table reversal within .001"; dog controlled table traverse stroke as short as 1/16"; automatic pressure lubricating system for table and wheelhead ways; dial controlled pick-feed adjustment. ¶ A tabulation of all design features and specifications may be obtained by writing for catalog G-520. A brief description of this machine will be found in Sweet's Catalog File for Mechanical Industries.

REDUCED SAMPLING TABLE 2—1% DEFECTIVE ALLOWABLE

1. Lot Size	2. Sample Size	3. No. Defective Allowed in Sample	4. Risk of Accepting a Lot 5% Defective
200- 300	70	1	.13
301- 500	80	1	.09
501- 1000	87	1	.07
1001- 2000	95	1	.05
2001- 3000	125	2	.05
3001- 4000	132	2	.04
4001- 5000	140	2	.03
5001- 7000	148	2	.02
7001- 10000	180	3	.02
10001- 20000	190	3	.01
20001- 50000	200	3	.01
50001-100000	210	3	.007

SIMPLIFIED SAMPLING TABLES—PLAN "B"
REDUCED SAMPLING

Sampling Plan "B" is a supplement to Quality Control Systems Letter No. 45.2, commonly referred to as Sampling Plan "A".

The recommended procedure for using Sampling Plan "B" is as follows:

If ten consecutive lots of an item pass Plan "A", change to Plan "B". If an item which is on Plan "B" fails the plan, even for a single lot, go back to Plan "A".

In Plan "B" the amount of inspection required is less than half of that required by Plan "A". The average quality of material accepted by Plan "B" is the same as that accepted by Plan "A", in the long run. However, the risk of accepting a single lot of inferior quality is greater with Plan "B" than with Plan "A". On the other hand, Plan "B" is not used until there is some assurance of uniform high quality; viz, ten consecutive lots of a particular item have been passed by Plan "A".

As an example of the use of Plan "B", suppose that ten consecutive lots of a certain item have passed Plan "A". Suppose, further, that we have a lot of 1325 parts. Let us assume that our allowable fraction defective for this item is 1%. We then refer to "Reduced Sampling Table 2, 1% Defective Allowable," in Sampling Plan "B", Quality Control Systems Letter No. 46.1.

Since we have 1325 parts, reference to the table will show that we must take a sample of 95 parts. We proceed to inspect these 95 parts very carefully. If we find *one defective part* or less we will accept the entire lot. If we find two or more defective parts we reject the lot, and either detail or return it to the supplier. Moreover, *for subsequent lots of this part, we go back to plan A until ten consecutive lots again pass inspection.*

This procedure assures us that *in the long run* the number of defective parts in accepted lots will not exceed 1%. However, we note in the column headed "Risk of Accepting a Lot 5% Defective" there is the figure .05 opposite sample size 95. This means that we might accept a *single lot* which contains as many as *5% defective parts* about 5% of the time, or about one time in twenty.

Fig. 3. Simplified Sampling Table 2, Plan "B". Quality Control Systems Letter No. 46.1, Reduced Sampling.

ing of a few pieces by the inspector to determine whether or not

(a) the operator really understands what is required
(b) the tools will produce parts of the required quality, and
(c) the operator has the skill to produce parts of the desired level of quality. This is particularly true in the case of assemblies where the assembler must make adjustments to the assembly he is putting together.

The results of "first piece" inspection may be conveniently recorded on a tag designed for this purpose. This tag made out by the inspector attests to the fact that he has examined the setup and the first few pieces produced, and that in his opinion these parts are of the proper quality.

If necessary, the inspector can inspect parts produced at regular intervals to determine whether or not the desired level of quality is maintained. The responsibility for this periodic inspection is pretty much in the hands of the inspector, who uses his judgment as to how often to inspect parts and with what thoroughness this inspection should be done. His aim is to maintain a proper level of quality with the minimum amount of inspection. When he feels that changes have taken place in the setup or tools which might result in lowering of the desired quality level, he causes the operation to be shut down and proper adjustments made to restore the quality level, such as sharpening tools or issuing new instructions to assemblers doing bench work.

The second method of controlling quality is by use of the conventional statistical control chart. This chart may be the p chart, c chart, X and R, or whatever is deemed to be the most effective form. The control chart is more effective for controlling the quality of hard-to-make items or items which have quality characteristics which must be held within very close limits.

Returning to the record of sampling results, Figure 2, experience shows that these records should be reviewed daily by a statistician with the aim of determining any irregularity in the level of quality of any item from lot to lot. He should also look for lots which are

(CONTINUED ON PAGE 168)

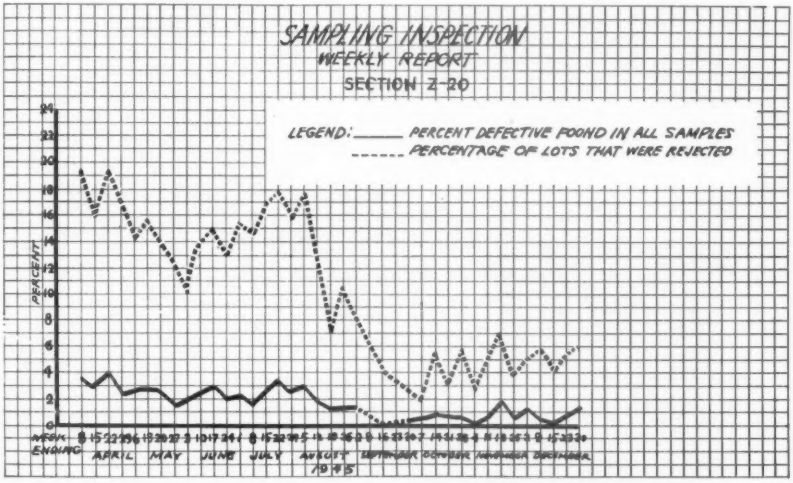


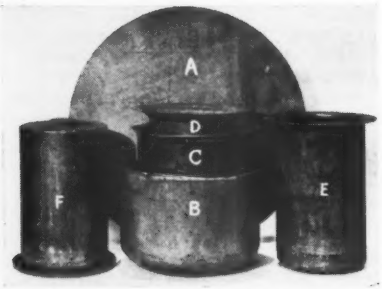
Fig. 4. Percent defective chart for Plant Manager.

Flange trimming, forming of vertical lip around top of filter shell and the punching of the lid fastening holes around the top of the case are the tooling descriptions continued in this series which covers the deep drawing operations performed on the presses of the Belleview (Ohio) Manufacturing Company in manufacturing the cases for Fram Oil Filters.

Deep Drawing Filter Cases

Part III* (Continued)

by Carl J. Nagel



The fifth operation of trimming the flange of the oil filter case is performed after the flange has been flattened and the forming of the bottom reinforcing ribs by the fourth operation, Figure 10, and the final deep draw to diameter of 6¼" and a depth of 11", Figure 9.

The detailed tooling and bill of materials is shown by Figure 12. The machined steel upper die block, detail A, Figure 12, is secured to the upper bolster plate, detail P, by means of the four standard 1" hex-head cap

A succession of workpieces representing the several operations of blanking, drawing, flanging, trimming and perforating the filter cases. Part III to date, TDJ, February, March and May 1946, has covered A, blanking the stock to 18¼" x .062"; B, the first draw, a shell 9¾" dia x 7" deep; the second draw, C, of 8" dia and 9" depth; D, the third and final draw to 6¼" dia x 11" deep; and the rib forming and flange flattening operations embodied in E. Bliss press tooling handles the first seven operations, with the final three run on Ferracute, Verson and Toledo presses, respectively. The case is fabricated from hot-rolled, pickled and oiled, low carbon steel blanked out from flat strip stock.

Fig. 16. Appearance of filter case after the operations detailed in Figure 12, flange trimming, Figure 13, forming of vertical lip, and Figure 14, hole punching.

*Part I, Tool & Die Journal, July 1945.

Part II, Tool & Die Journal, August and September 1945.

Part III, Tool & Die Journal, February, March and May 1946.

FIGURE 12 TYPE F-40 FRAM FILTER

BILL OF MATERIALS			BILL OF MATERIALS			BILL OF MATERIALS		
DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.
A	MACHINE STEEL DIE BLOCK	1	J	STD. 1" LOCK-WASHERS	8	S	STD. $\frac{1}{2}$" CAP SCREWS	4
B	STD. $\frac{1}{2}$" CAP SCREWS	4	K	STD. $\frac{1}{2}$" LOCK-WASHERS	4	T	BOTTOM BOLSTER PLATE	1
C	MACHINE STEEL PILOT PUNCH ADAPTER	1	L	STD. $\frac{1}{2}$" HEX. HD. CAP SCREWS	4	U	TOOL STEEL BOTTOMING PUNCH	1
D	HIGH SPEED STEEL UPPER TRIM DIE	1	M	MACHINE STEEL BOTTOMING PUNCH ADAPTER	1			
E	HIGH SPEED STEEL LOWER TRIM DIE	1	N	STD. 1" MACHINE BOLT	1			
F	MACHINE STEEL LOWER DIE BLOCK	1	P	UPPER BOLSTER PLATE	1			
G	PICKLED AND OILED HOT ROLLED MATERIAL STOCK	1	Q	STD. C.R. 2" STEEL STUD	1			
H	STD. 1" HEX. HD CAP SCREWS	8	R	TOOL STEEL PILOT PUNCH	1			

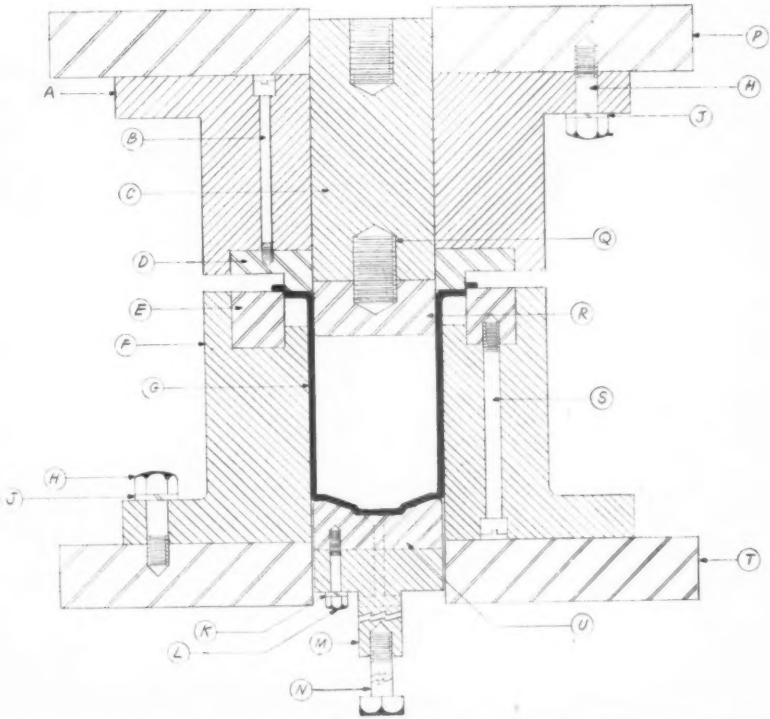


Fig. 12. Bill of material and X-section of the tooling for the fifth operation of trimming the flattened flange around the top of the shell after the final draw to a 6¼" dia and 11" depth.

FIGURE 13 TYPE F-40 FRAM FILTER

BILL OF MATERIALS			BILL OF MATERIALS			BILL OF MATERIALS		
DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.	DET.	DESCRIPTION	REQ.
A	MACHINE STEEL UPPER DIE BLOCK	1	J	STD. $\frac{1}{2}$" LOCK WASHERS	4	S	TOOL STEEL PILOT PUNCH	1
B	STD. $\frac{3}{4}$" CAP SCREW	4	K	STD. $\frac{1}{2}$" HEX. HD. CAP SCREWS	4	T	STD. $\frac{3}{4}$" CAP SCREWS	4
C	TOOL STEEL FLANGING DIE	1	L	MACHINE STEEL BOTTOMING PUNCH ADAPTER	1	U	LOWER BOLSTER PLATE	1
D	TOOL STEEL LOWER FLANGING DIE	1	M	STD. 1" MACHINE BOLT	1	V	TOOL STEEL BOTTOMING PUNCH	1
E	MACHINE STEEL LOWER DIE BLOCK	1	N	UPPER BOLSTER PLATE	1			
F	PICKLED AND OILED HOT ROLLED MATERIAL STOCK	1	P	STD. PRESSURE COIL SPRING	4			
G	STD. 1" HEX. HD CAP SCREW	8	Q	STD. 2" C.R. STEEL STUD	1			
H	STD. 1" LOCK WASHERS	8	R	TOOL STEEL DIE RING	1			

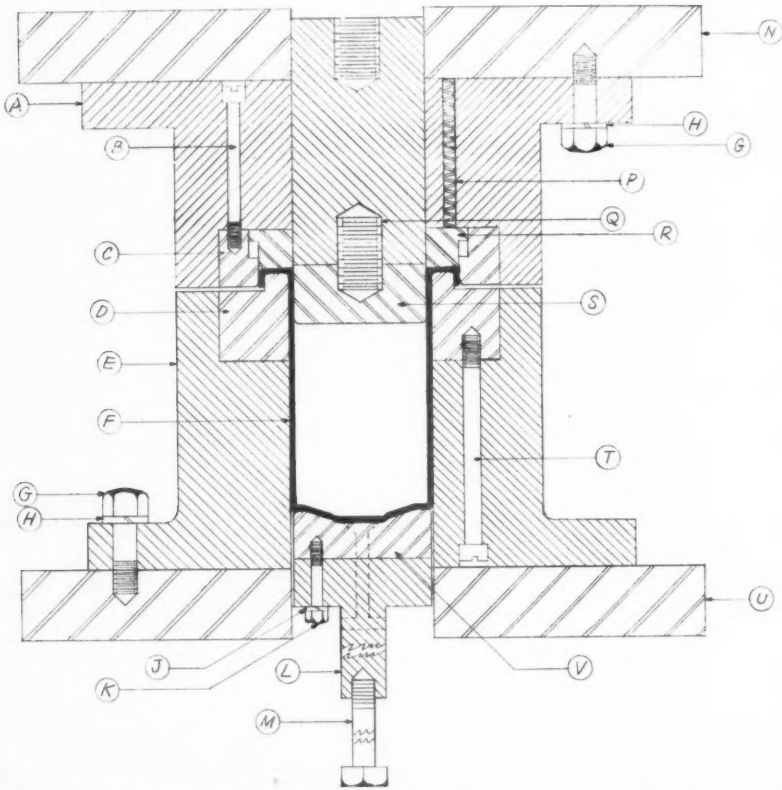


Fig. 13. Tooling setup on Bliss press for the sixth operation of forming a vertical lip around the top flange.

screws with standard 1" lock washers, details H and J.

Detail D shows the hardened and ground tool steel upper die ring and trimming punch which is bolted to the upper die block, detail A, by the four standard socket head or fillister head cap screws, detail B.

The punch adapter, detail C, is the same machined steel adapter as used in the tooling for the fourth operation, Figure 10, and carries the hardened and ground tool steel pilot punch, detail R, which is secured by the standard 2" steel stud bolt, detail Q, Figure 12.

Detail F is of the machined steel lower die block which is bolted to the lower bolster plate, detail T, by the four standard 1" hex-head cap screws and standard lock washers, details H and J.

The lower die ring and trimming punch, detail E, is retained in the lower die block, detail F, by four equi-spaced ¾" socket head or fillister head cap screws, one of which is shown by detail S.

The bottoming punch assembly, detail U, made up of the fastening bolts and lock washers, details K and L, bottoming punch adaptor, detail M, and knockout adustment screw, detail N, is the same as served for the filter case knockout in the fourth operation, Figure 10. The fully drawn shell being drawn down to the bottoming punch in the flange trimming operation necessitates the provision for escape of entrapped air through the bored outlets shown by the dotted lines in the punch pad and adaptor members. The upper punch assembly does not travel sufficiently far into the shell to cause an air suction problem, hence no bores are shown in the upper punch adaptor although, as previously stated, it is the same assembly as used in the tooling of the fourth operation, Figure 10. The bores should have been shown through the upper punch adaptor of Figure 12, detail C, but not in the punch proper, detail R.

Following this fifth operation the shells are conveyed by 4-wheel hand trucks to the sixth operation, which is that of forming the vertical lip around the top of the shell by drawing down the trimmed flange by the tooling setup of Figure 13, page 100.

(To be concluded next month)

Coming in October:

A TOOLING PROGRAM FOR FORGED GLOBE VALVES, PART I
beginning a series on the complete tooling of brass valve bodies: from forging die master blocks, through multiple spindle tools to inspection and finishing setups.

THE FLEXIBILITY OF PRESS BRAKE TOOLING
showing how the Press Brake can be tooled for production of simple shapes or intricate telephone and refrigerator components.

TOOL DESIGN REQUIREMENTS FOR BROACHING BRASSES AND BRONZES
covering broach and broach tooth design for working in these metals; chip behavior and control; product design factors governing successful broaching.

QUALITY CONTROL
more practical know-how covering the statistical interpretation of inspection procedures.

MILLING CUTTER DESIGNS AND GRINDS
describing a program of simplifying the designing and grinding of inserted-blade cutters to insure continuous production through cutter interchangeability.

DEEP DRAWING OF FILTER CASES
the concluding description of the finishing operations on the deep-drawn Fram Oil Filter bodies.

PRECISION PRODUCTION BY MAN-AU-TROL SPACING
a new development by Bullard for the precision locating, by hydraulic control, of workpieces for drilling, tapping, boring and reaming operations, without intricate jigs and fixtures.

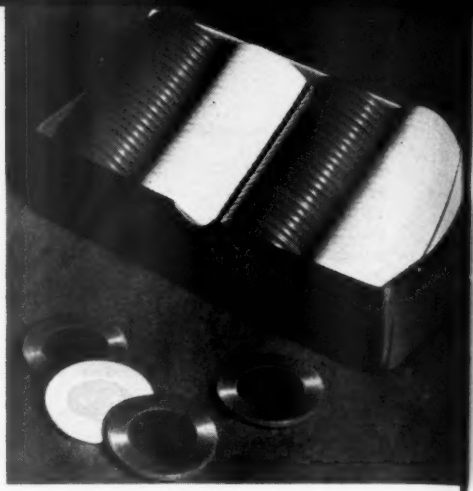


Fig. 1. The poker chip specifications called for radial knurls and damasked centers. Compression molded of Plaskon urea, the chips met all requirements as to weight, ring and color.

The Design and Molding of Poker Chips*

by John G. Robb
Engineer
The American Molding Co.
San Francisco, Calif.

Recently our company was confronted with the problem of making a quality poker chip for a discriminating customer. We were to design and build the mold in addition to doing the molding job. The requirements were rather rigid since the idiosyncrasies of people who use poker chips had to be considered, also their desire for distinctive chips.

The color requirements and raw material costs eliminated a number of compounds and narrowed the field of possible materials down to this choice of three: urea, cellulose acetate butyrate or polystyrene. The final consumer and the buyers in the stores that sell poker chips prefer to have chips that have a definite ring when they hit each other or the table. This eliminated the dead sounding butyrate and left us with a choice between compression molding with urea or injection molding with polystyrene.

Both these materials have the necessary characteristics to make good poker chips. They do not warp, they have the desired sound and feel when handled, and can be obtained in a wide range of colors from which attractive shades of the three standard poker chip colors, white, red and blue can be selected.

Urea has a higher specific gravity than polystyrene and therefore gives a slightly heavier chip which seems to be a desirable feature. This fact combined with availability of raw material and production time in our own shop tipped the scales in favor of the urea chip. From a purely cost standpoint the polystyrene chip might have been favored, but the cost margin is small. In this case the advantages for both customer and for our own production determined us in favor of urea. We used Plaskon urea molding powder.

With the material selected, our next problem was the choice of a proper design, Figure 1. The chips were to be interlocking so that they would stack readily. A radial knurl around the outer portion of both faces gives them this property. Most interlocking chips are plain in the middle of the face, but in order to break this flatness we decided to damask this portion. This gave a very pleasing matte effect, and added definitely to the attractiveness of the chips.

The compression mold used to make the chips contained thirty cavities. More cavities would have been desirable, but available press capacity was the limiting factor in this choice. The mold, Figure 2, is a flash type and contains no ejector pins, because the chips can be quickly blown out of the shallow cavities with an air hose as the mold opens. On

*For those TOOL & DIE JOURNAL readers who like to kibitz on the plastics game, we boldly toss in these chips to sweeten the pot. In two concise pages, Mr. Robb tells a highly informative plastics story, from product design through tooling to shipping platform. Grateful acknowledgment is made to the editorial staff of INDUSTRIAL PLASTICS for this unprecedented exposure to such stakes without loss of shirt. Ed.

a piece of this kind, a semi-automatic mold with ejector pins would not have resulted in any faster production, would have upped mold cost, and would complicate maintenance. Also, a mark would be made on each chip.

The mold is mounted in the press and is opened by the press action. The urea material is tabletted in a standard preforming or pill machine, and the preforms are placed in a loading board, Figure 3, having thirty recesses to match the cavities in the mold. As the mold opens, an air jet blows the chips and the flash out of the mold; the operator places the loading board over the bottom half of the mold, and trips the plate thus allowing the preforms to fall into the cavities. The press is then closed and the loading board is refilled on the bench while the chips are curing.

The mold cavities were hobbed in order to get the interlocking knurl into the cavities. This method assured exact duplicate cavities at a minimum cost. The damask in the center was worked into the cavities after they had been hardened and polished in order that the after hardening polish operation would not remove the effect. The hobbed cavities were set into recesses bored in the cavity retainer plates and then mounted on steam channeled heating plates.

On an item such as poker chips, finishing cost can very easily get out of hand when a high quality product is specified. To avoid this, considerable thought must be given to the problems of flash removal and of polishing out the rough lines left by this operation.

As the chips are blown from the mold they fall down a chute into a tumbling barrel mounted at the rear of the press, Figure 4. This barrel is at an angle so that chips feed by gravity and come out the end with flash removed.

In order to do a really good job on the rim surface it was necessary to sand and buff the chips thoroughly. The cost of these operations if done manually would be prohibitive on so highly competitive an item. The tumbled chips are poured into a hopper and pass over a belt sander and buffers, from which they are discharged completely finished and ready for shipment.

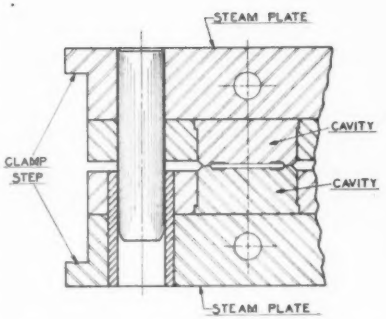


Fig. 2. X-section through flash type compression mold as designed for poker chip production.

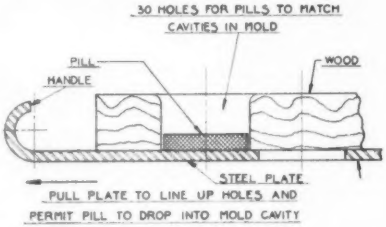

30 HOLES FOR PILLS TO MATCH CAVITIES IN MOLD
PILL HANDLE
WOOD
STEEL PLATE
PULL PLATE TO LINE UP HOLES AND PERMIT PILL TO DROP INTO MOLD CAVITY

Fig. 3. X-section of mold loading board which locates preformed pills over mold cavities.

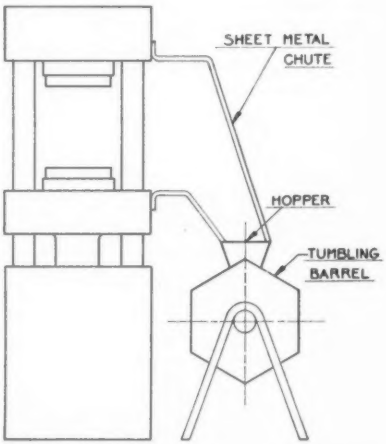
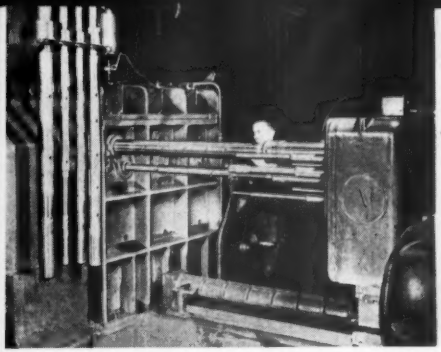
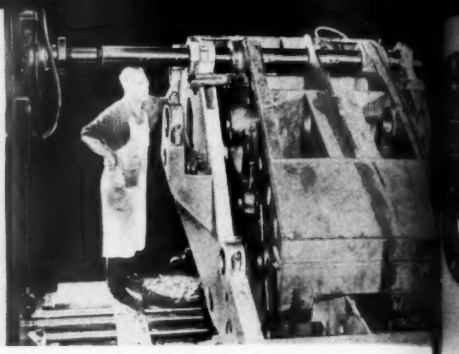


Fig. 4. Press and tumbler setup. The tumbling barrel axis is inclined sufficiently to enable the chips to feed through by gravity.





Boring Tools Simplify Design Changes

It is often necessary to modify boring bars and cutters, rather than the machine, when changes are made in the design of machined parts. Special boring units, turret lathes, horizontal boring machines, etc., are readily adapted to specific work when correctly designed bars are used. By taking full advantage of various standard and special boring bars and cutters, production engineers have found it both possible and practical to use machines on hand to perform work which has been changed in design. Specially designed boring bars can often be used on various types of horizontal boring equipment when doing unusual or complex boring operations. These bars are equipped with expanding and retracting type cutters, depending upon the operation. One important use for such bars and cutters is the boring of large engine blocks. A Davis Micrometer Boring Bar, ready to finish bore crankshaft and cam bearings, is shown above.

Bars with block type tool can be used for internal grooving, recessing, counterboring, and chamfering. A block type cutter, showing the adjusting screw and various cutter arrangements, is illustrated below. The stub boring bar, pictured here, has two block type cutters, the first for roughing and the second for semi-finishing. The last picture shows a precision boring operation on a turntable being performed with block type cutters in a line bar. Multiple boring cuts are performed simultaneously, by using stub boring bars with expanding block cutters. Instead of single point tools to rough, semi-finish and finish bore in three passes, special bars with expanding blocks properly spaced complete the bore in one pass.

When cutters become dull, the complete block is removed and cutters ground in the block and then replaced with a minimum of adjusting.

Just as it is possible to obtain different types of bars for boring needs, it is also possible to obtain different cutter blocks for the bars. Many standard bars are available for immediate needs. Special boring bars are made to order, depending upon boring requirements. Engineering service is extended to boring equipment users who have specific and difficult machining problems.

Write Davis Boring Tool Division of Giddings & Lewis Machine Tool Company, Dept. DJ, Fond du Lac, Wis. INFORM-A-GRAM Key No. 43-P.

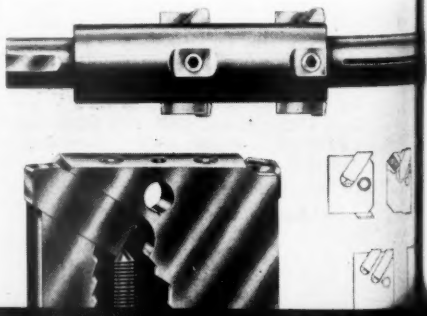


Fig. 7. A representative array of parts, ranging from saxophones through bicycle hubs to index drums, that utilize marking equipment for names, trademarks, specifications, graduations or serial numbers.

Your Shaper Makes A Fine Marking Machine

by H. O. Bates*

For many applications that can be expediently tooled up, your shaper is the best marking machine. It has the power and the strength, together with accuracy of control, that enable it to perform the marking of flat or curved surfaces with the utmost ease and satisfaction.

All that is required is a simple holding fixture for securing the marking die to the business end of the shaper ram, and a supporting surface, vise or clamp, to hold the work while marking.

For the marking of cylindrical parts, such as rods, shafts or spindles, the set-up diagrammed in Figure 1 is simple and fast working. With each forward stroke of the ram, the cylindrical piece is contacted by the marking die and the mark is rolled in as the piece rolls forward. The marking die is held by the shaper ram, and the shaper table proper is provided with an auxiliary, hardened and ground work supporting plate of

*President, The Acromark Company, Elizabeth 4, New Jersey.

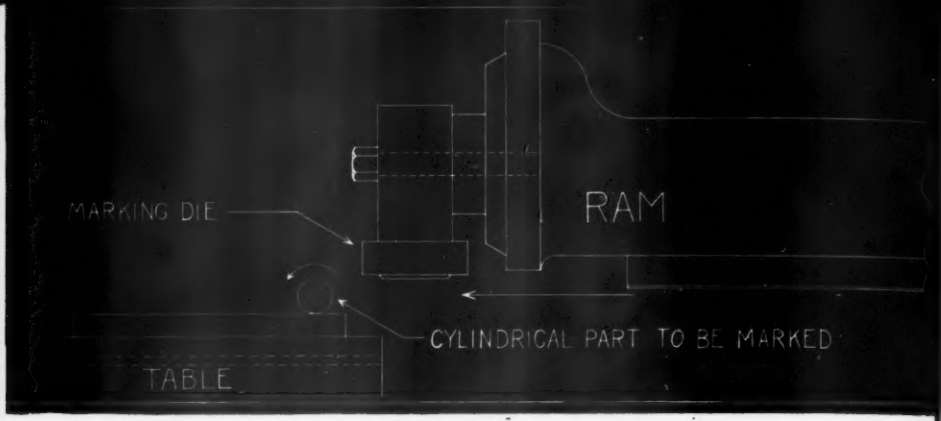


Fig. 1. A straight line, solid marking die is passed over the cylindrical work by the shaper ram. The power and rigidity of a shaper can be utilized for heavy-duty marking.

appropriate size to the job. The length of stroke and speed of the ram can be paced to the loading and unloading of the work by the operator. Spring wire locating fingers can be rigged to position the work for the start of the roll, so that the workpiece does not have to be painstakingly positioned by the operator. As the work is started rolling by the marking die, the spring wire retainers would momentarily be wiped aside. Just beyond the end of the work travel, as the work leaves the marking die, a chute could be arranged to feed the work into a tote pan. By such improvisations a really high production marking rate can be attained.

For the marking of flat parts or surfaces the shaper can be tooled up as suggested by Figure 2. Here the marking die is in the form of a roller that is passed over the surface to be marked. The marking die or roll is fastened to the ram by the special roll holder. The piece to be marked is held in the shaper vise. As the ram travels forward, a pin on the marking roll contacts the edge of the work and brings the leading edge of the circular marking die into contact with the work, and as the roll progresses the markings are impressed on the workpiece. The ram travel can be timed to permit unloading of the work after the marking stroke if a fast working vise or work clamp is employed.

As soon as the marking roll has passed over the work, the spring return arrangement on the roll shaft flips the marking roll around to its starting position. In the event that the work cannot be unloaded before the back travel of the ram, the pin again comes into play by riding across the workpiece, hence keeping the marking periphery of the roll die clear of the marked surface.

The above innovations and expedients for production marking are predicated on the availability of toolroom or production department shapers for occasional marking jobs. Obviously the capital investment in and potential earning power of such machine tools as shapers mitigates against their full-time use as marking machines.

There are several comparatively low-priced, general purpose marking machines available in sufficient variety of sizes and capacities to take care of all production marking requirements. Of these, one of the most popular is of either bench or pedestal design, is sturdily constructed, and is as readily tooled for different jobs as the shaper setup described above. This machine, designated as the Acromark No. 9A, is shown in Figure 3 as set up for the marking of cylindrical work such as rods, shafts, drills, bushings, etc. By one pass of the hand lever, a uniform mark of any desired depth is made and another piece is marked on the return stroke. Serial numbering is accomplished with an automatic numbering head and repeat numbering results from a simple adjustment.

An example of an easily devised, special anvil for supporting cylindrical, multi-diameter work is shown in the close-up of Figure 4. This same basic model, pedestal mounted and equipped with motor drive and clutch, is illustrated in Figure 5. In this setup, the work support or anvil is a pair of rolls which permits the marking of flat pieces with a roller die and the marking of round pieces with a flat straight line die.

In those instances where the parts to be marked are large and heavy, marking machines of greater capacities (either hand or power operated) are designed to be mounted on a low platform, so the heavy pieces can be brought to the machine by truck and fed without lifting. The low mounting also gives the operator ample leverage, permitting him to stand in an upright position.

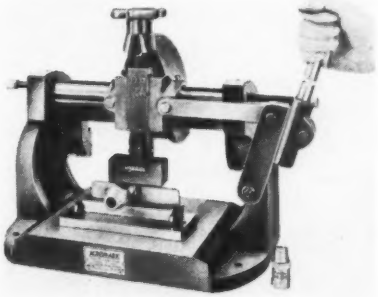


Fig. 3. With this general purpose marking machine, each stroke of the hand lever performs a marking operation.

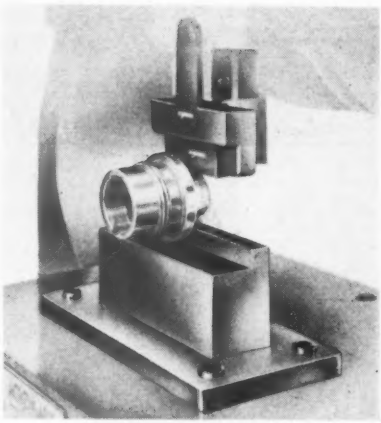
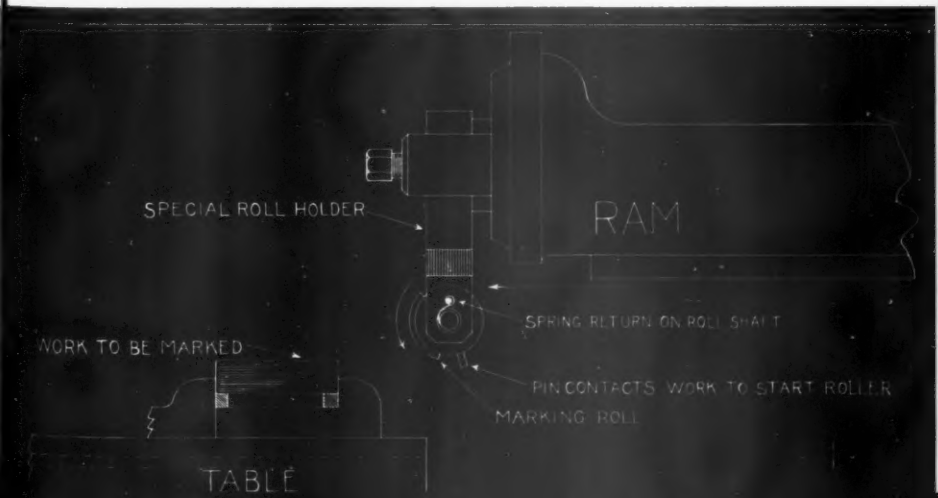


Fig. 4. An example of an easily devised, special anvil for supporting cylindrical, multi-diameter workpieces. Where such work might be more readily supported by its ID, an anti-friction arbor could be employed.

Fig. 2. Here the shaper ram carries a marking roll in a special holder for rolling across and marking flat parts or surfaces. The work can be held by the shaper vise or by faster working clamps or fixtures.



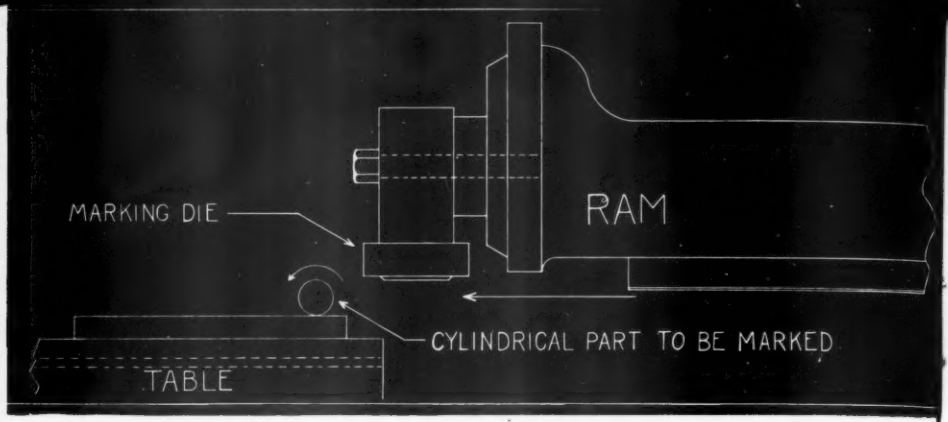


Fig. 1. A straight line, solid marking die is passed over the cylindrical work by the shaper ram. The power and rigidity of a shaper can be utilized for heavy-duty marking.

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As soon as the marking roll has passed over the work, the spring return arrangement on the roll shaft flips the marking roll around to its starting position. In the event that the work cannot be unloaded before the back travel of the ram, the pin again comes into play by riding across the workpiece, hence keeping the marking periphery of the roll die clear of the marked surface.

The above innovations and expedients for production marking are predicated on the availability of toolroom or production department shapers for occasional marking jobs. Obviously the capital investment in and potential earning power of such machine tools as shapers mitigates against their full-time use as marking machines.

There are several comparatively low-priced, general purpose marking machines available in sufficient variety of sizes and capacities to take care of all production marking requirements. Of these, one of the most popular is of either bench or pedestal design, is sturdily constructed, and is as readily tooled for different jobs as the shaper setup described above. This machine, designated as the Acromark No. 9A, is shown in Figure 3 as set up for the marking of cylindrical work such as rods, shafts, drills, bushings, etc. By one pass of the hand lever, a uniform mark of any desired depth is made and another piece is marked on the return stroke. Serial numbering is accomplished with an automatic numbering head and repeat numbering results from a simple adjustment.

An example of an easily devised, special anvil for supporting cylindrical, multi-diameter work is shown in the close-up of Figure 4. This same basic model, pedestal mounted and equipped with motor drive and clutch, is illustrated in Figure 5. In this setup, the work support or anvil is a pair of rolls which permits the marking of flat pieces with a roller die and the marking of round pieces with a flat straight line die.

In those instances where the parts to be marked are large and heavy, marking machines of greater capacities (either hand or power operated) are designed to be mounted on a low platform, so the heavy pieces can be brought to the machine by truck and fed without lifting. The low mounting also gives the operator ample leverage, permitting him to stand in an upright position.

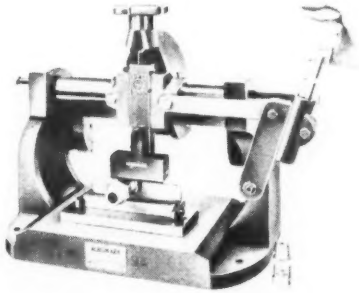


Fig. 3. With this general purpose marking machine, each stroke of the hand lever performs a marking operation.

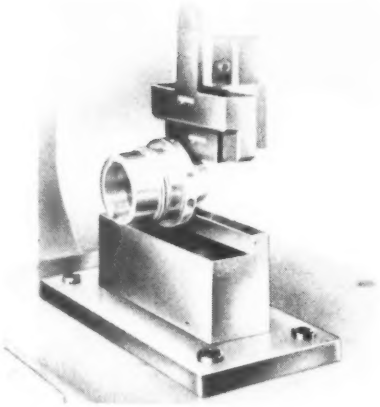


Fig. 4. An example of an easily devised, special anvil for supporting cylindrical, multi-diameter workpieces. Where such work might be more readily supported by its ID, an anti-friction arbor could be employed.

Fig. 2. Here the shaper ram carries a marking roll in a special holder for rolling across and marking flat parts or surfaces. The work can be held by the shaper vise or by faster working clamps or fixtures.

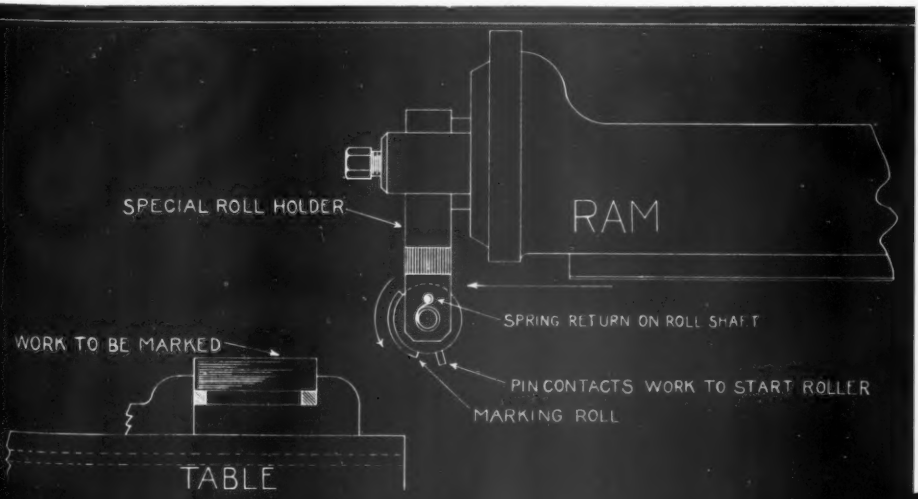


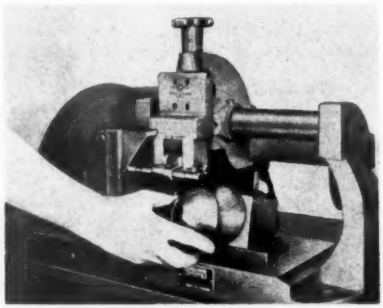
Fig. 5. For high production demands these machines can be had in pedestal form and with motor drive and clutch.

Special and irregular shapes can best be accommodated by the construction of holding fixtures that will bring the surface to be marked parallel to the travel of the marking die. Figure 6 is illustrative of a setup such as is used for marking conical or spherical surfaces. An appropriately designed fixture facilitates rapid loading and unloading of the work. This type of machine is often employed for the simultaneous operations of repetitive marking and consecutive numbering, and combines marking die inserts in the frame of the machine with a numbering head for numerical serializing.

All of these machines offer the economics of standardized type holders and interchangeable type which is made of a hardened alloy tool steel, machine engraved and designed to withstand long marking service. Where only a company name, trademark or model number is the extent of the production marking, it is well to buy solid flat dies or roller dies engraved with that specific designation.

Due to the lack of general information concerning engraved dies, even an experienced shop man may assume that any engraved steel die will do his marking. This is not so, and care should be taken to specify the right kind of engraving. For steel marking, "heavy duty" engraving should be specified because this will insure, if ordered from a reputable engraver, that the letters or numbers have a sufficient bevel to each character so as not to break as side pressure is applied during the marking travel. Marking die characters of slight bevel and knife-like edges break off easily and cannot be repaired. This necessitates the replacement of costly engraving.

Fig. 6. With the proper holding fixtures the marking of spherical or conical parts is as simple as marking flats and rounds.



Annual Meeting of National Tool & Die Manufacturers Association

The annual meeting of NTDMA will be held at the Congress Hotel, Chicago, October 23rd through the 26th. This will be the first big general membership meeting. Committee and Board of Directors meetings will be held Wednesday and Thursday, with general membership sessions scheduled for Thursday and Friday. The annual Dinner-Dance will take place Friday evening, with Saturday left open for sight-seeing.

TDJ SHOP DATA SHEET NO. 46

Induction and Dielectric Data
R.F. and Induction Heating Formulas

GENERAL R.F. HEATING FORMULAS

1. **Load Thermal Power Requirement:**

$Pkw = 2.93 \times 10^{-4}$ MC T (kilowatts).

P = load thermal power requirement.

M = lbs/hr of material to be heated.

C = specific heat of substance.

$\triangle T$ = temperature rise in degrees F.

2. **Alternating Current Resistance Of A Conductor:**

$R = .405 \sqrt{f}\, dR_{dc}$ (ohms).

R = ac resistance of conductor.

f = frequency in cy/sec.

d = dia of conductor in inches.

R_{dc} = dc resistance of a solid conductor of equal dia.

3. **Capacitive Reactance:**

$$X = \frac{1}{wC} \text{(ohms)}.$$

X = capacitive reactance (ohms).

$w = 2\pi f$.

C = capacity (farads).

f = frequency (cy/sec).

4. **Radiation And Convection Loss From Surface (Thermal Losses):**

$$W_r = 37e \left[\left(\frac{T_1}{1000} \right)^4 - \left(\frac{T_2}{1000} \right)^4 \right]$$

watts/sq in.

$W = .001^h$ 4/3 watts/sq in.

$T^c = 5/9$ F 255.4.

F = degrees F.

$H = 5/9 \triangle F$.

e = relative emissivity = 1 for black body radiation.

5. **Inductive Reactance:**

$X = 2\pi$ fL ohms.

X = inductive reactance (ohms).

f = frequency cy/sec.

L = inductance in henries.

INDUCTION HEATING FORMULAS

1. **Power Input Into A Non-Magnetic Cylinder:**

$$*P_v = \frac{16.3 H_o^2}{d} \sqrt{fp} \times 10^{-7}$$

(watts/cu in).

P_v = power density in watts/cu in.

H_o = peak magnetizing force (oersteds).

P = resistivity of work in micro-ohms-cms.

d = outside diameter of cyl in inches.

f = frequency in cy/sec.

2. **Power Input Into A Non-Magnetic Slab:**

$$*P_v = \frac{8.15\ H_o^2 \sqrt{fp} \times 10^{-7}}{t}$$

(watts/cu in).

P_v = power density in watts/cu in.

H_o = peak magnetizing force (oersteds).

p = resistivity of work in micro-ohm-cms.

t = thickness of slab in inches.

f = frequency in cy/sec.

3. Power Input Into A Magnetic Cylinder:

$$*P_v = \frac{2.75 \times 10^{-4}}{d}\sqrt{pf}\ H_o^{3/2}$$

(watts/cu in).

P_v = power density in watts/cu in.

d = dia of cylinder in inches.

p = resistivity of material in micro-ohms-cms.

f = frequency in cy/sec.

H_o = peak magnetizing force (oersteds).

4. Power Input Into A Magnetic Slab:

$$*P_v = \frac{1.37 \times 10^{-4}}{t}\sqrt{pf}\ H_o^{3/2}$$

(watts/cu in).

P_v = power density in watts/cu in.

p = resistivity of material in micro-ohms-cms.

f = frequency in cy/sec.

H_o = peak magnetizing force (oersteds).

t = thickness of slab in inches.

5. Depth Of Current Penetration In A Non-Magnetic Conductor:

$$\delta = 1.98\sqrt{\frac{p}{f}}\ \text{(inches)}.$$

δ = depth of current penetration.

p = resistivity of work in micro-ohms-cms.

f = frequency in cy/sec.

6. Depth Of Current Penetration In Magnetic Conductor:

$$\delta = 1.98\frac{H_o p}{Bf}\ \text{(inches)}.$$

δ = depth of current penetration.

H_o = peak magnetizing force (oersteds).

p = resistivity of material in micro-ohms-cms.

f = frequency in cy/sec.

B = flux density in material—gauss (usually assumed as 16,000).

7. Coil Voltage And Current:

$$E = H_o\ (2.86 \times 10^{-7}\ NAFK_2)\ \text{volts (rms)}.$$

$$I = H_o\ (1.43\frac{1}{N})\ \text{amps (rms)}.$$

E = coil voltage in volts (rms).

I = coil current in amps (rms).

H_o = peak magnetizing force (oersteds).

N = number of turns in coil.

A = cross section area in coil (sq in).

l = length of coil in inches.

K_2 = coil voltage factor.

F = frequency in cy/sec.

8. Coil Inductance:

$$L = \frac{r^2n^2}{9r+101}\ \text{microhenries}.$$

r = mean radius of coil.

n = number of turns.

l = length.

*Formula applicable only if depth of penetration (δ) is less than ½ thickness (t) of slab or less than the wall thickness (t) of a cylinder and if the wall thickness is less than 1/10 of the diameter of the cylinder.

Courtesy of the Industrial Electronics Division, Westinghouse Electric Corporation, Baltimore, Maryland.

TDJ SHOP DATA SHEET NO. 47

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)				
	10.00	10.50	11.00	11.50	12.00
3.125	11.61	11.88	12.13	12.39	12.64
3.250	11.86	12.13	12.39	12.65	12.90
3.375	12.10	12.37	12.64	12.91	13.17
3.500	12.34	12.62	12.89	13.16	13.43
3.625	12.57	12.86	13.14	13.41	13.68
3.750	12.80	13.09	13.37	13.65	13.93
3.875	13.04	13.33	13.62	13.90	14.18
4.000	13.26	13.56	13.85	14.14	14.42
4.125	13.49	13.79	14.09	14.38	14.66
4.250	13.72	14.02	14.32	14.61	14.90
4.375	13.93	14.24	14.54	14.84	15.13
4.500	14.15	14.45	14.77	15.07	15.37
4.625	14.36	14.68	14.99	15.30	15.60
4.750	14.57	14.90	15.22	15.52	15.83
4.875	14.79	15.11	15.43	15.74	16.05
5.000	15.00	15.33	15.65	15.97	16.28
5.125	15.21	15.54	15.87	16.19	16.50
5.250	15.41	15.75	16.08	16.40	16.72
5.375	15.61	15.95	16.29	16.61	16.93
5.500	15.82	16.16	16.50	16.83	17.15
5.625	16.02	16.36	16.70	17.04	17.36
5.750	16.21	16.57	16.91	17.25	17.58
5.875	16.42	16.77	17.11	17.45	17.79
6.000	16.61	16.97	17.32	17.66	18.00

TDJ SHOP DATA SHEET NO. 48

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	.500	.625	.750	.875	1.00	1.125
6.250	7.18	7.39	7.60	7.80	8.00	8.19
6.500	7.43	7.64	7.85	8.06	8.26	8.45
6.750	7.68	7.90	8.11	8.31	8.51	8.71
7.000	7.93	8.15	8.36	8.57	8.77	8.97
7.250	8.18	8.40	8.62	8.82	9.03	9.22
7.500	8.44	8.66	8.87	9.08	9.28	9.48
7.750	8.69	8.91	9.12	9.33	9.54	9.74
8.000	8.94	9.16	9.38	9.59	9.79	10.00
8.250	9.19	9.41	9.63	9.84	10.05	10.25
8.500	9.44	9.66	9.88	10.10	10.30	10.51
8.750	9.69	9.92	10.13	10.35	10.56	10.76
9.000	9.95	10.17	10.39	10.60	10.81	11.02
9.250	10.20	10.42	10.64	10.85	11.07	11.27
9.500	10.45	10.67	10.89	11.11	11.32	11.53
9.750	10.70	10.92	11.14	11.36	11.57	11.78
10.000	10.95	11.18	11.40	11.61	11.83	12.04
10.250	11.20	11.43	11.65	11.87	12.08	12.29
10.500	11.45	11.68	11.90	12.12	12.33	12.54
10.750	11.70	11.93	12.15	12.37	12.59	12.80
11.000	11.95	12.18	12.40	12.62	12.84	13.05
11.250	12.20	12.43	12.67	12.91	13.09	13.30
11.500	12.45	12.65	12.90	13.11	13.35	13.56
11.750	12.66	12.92	13.16	13.39	13.59	13.82
12.000	12.96	13.20	13.42	13.63	13.86	14.07

TDJ SHOP DATA SHEET NO. 49

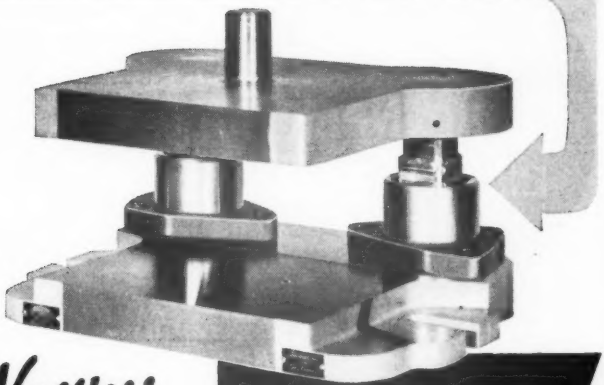
Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	2.000	2.250	2.500	2.750	3.000	3.250
6.250	9.44	9.76	10.07	10.38	10.68	10.96
6.500	9.71	10.03	10.35	10.66	10.96	11.25
6.750	9.97	10.31	10.63	10.94	11.25	11.54
7.000	10.24	10.58	10.90	11.22	11.53	11.83
7.250	10.51	10.85	11.18	11.50	11.81	12.11
7.500	10.78	11.12	11.45	11.77	12.09	12.39
7.750	11.04	11.39	11.72	12.05	12.37	12.68
8.000	11.31	11.66	11.99	12.32	12.64	12.96
8.250	11.57	11.92	12.27	12.60	12.92	13.23
8.500	11.84	12.19	12.53	12.87	13.20	13.51
8.750	12.10	12.46	12.80	13.14	13.47	13.79
9.000	12.36	12.72	13.07	13.41	13.74	14.07
9.250	12.63	12.99	13.34	13.68	14.02	14.34
9.500	12.89	13.25	13.61	13.95	14.29	14.61
9.750	13.15	13.52	13.87	14.22	14.56	14.89
10.000	13.41	13.78	14.14	14.49	14.83	15.16
10.250	13.67	14.04	14.40	14.75	15.10	15.43
10.500	13.93	14.30	14.66	15.02	15.36	15.70
10.750	14.19	14.56	14.93	15.29	15.63	15.97
11.000	14.45	14.83	15.19	15.55	15.90	16.24
11.250	14.71	15.08	15.46	15.82	16.17	16.52
11.500	14.97	15.35	15.72	16.08	16.43	16.78
11.750	15.22	15.60	15.98	16.34	16.70	17.05
12.000	15.50	15.88	16.24	16.61	16.96	17.32

TDJ SHOP DATA SHEET NO. 50

Approximate Blank Diameters for Drawn Shells (inches)

SHELL DIAM.	DEPTH OF DRAW (inches)					
(inches)	3.500	3.750	4.000	4.250	4.500	4.750
6.250	11.25	11.52	11.79	12.05	12.31	12.56
6.500	11.54	11.82	12.09	12.36	12.62	12.87
6.750	11.83	12.11	12.39	12.66	12.92	13.18
7.000	12.12	12.40	12.68	12.96	13.23	13.49
7.250	12.41	12.70	12.98	13.25	13.52	13.79
7.500	12.69	12.99	13.27	13.55	13.82	14.09
7.750	12.98	13.27	13.56	13.84	14.12	14.39
8.000	13.26	13.56	13.85	14.14	14.42	14.69
8.250	13.54	13.84	14.14	14.43	14.71	14.99
8.500	13.82	14.13	14.43	14.72	15.00	15.28
8.750	14.10	14.41	14.71	15.00	15.29	15.58
9.000	14.38	14.69	14.99	15.29	15.58	15.87
9.250	14.66	14.97	15.28	15.58	15.87	16.16
9.500	14.94	15.25	15.56	15.86	16.16	16.45
9.750	15.21	15.53	15.84	16.14	16.44	16.74
10.000	15.49	15.81	16.12	16.43	16.73	17.02
10.250	15.76	16.08	16.40	16.71	17.01	17.31
10.500	16.03	16.36	16.68	16.99	17.29	17.59
10.750	16.31	16.63	16.95	17.27	17.58	17.88
11.000	16.58	16.91	17.22	17.55	17.86	18.16
11.250	16.84	17.17	17.50	17.81	18.12	18.44
11.500	17.11	17.45	17.78	18.09	18.41	18.71
11.750	17.39	17.73	18.05	18.38	18.70	19.01
12.000	17.66	18.00	18.33	18.64	18.97	19.28



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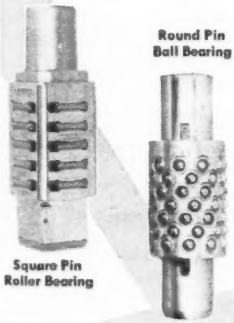

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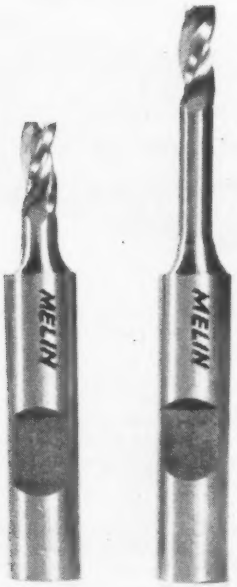
New "Long Neck" END MILLS MADE BY MELIN

DEEP CAVITY MILLING IS EASY WHEN YOUR TOOL IS A MELIN "LONG NECK" END MILL. Designed for greater accessibility to hard-to-reach cavities, Melin "Long Neck" End Mills are made for long life at high speeds. Created to fill a definite milling need, these tools are available in the standard bottom cutting and ball or radius ends. Each "Long Neck" Mill is ground only slightly undersize between the flutes and the shank for clearance, thus maintaining maximum strength. Sizes offered range from 3/32" to 3/8" dia with 3/8" shank, 2 3/8" to 3 1/16" overall length; 7/16" and 1/2" dia with 1/2" shank, 3 7/8" and 4 1/16" overall length. These "Long Neck" Mills can also be furnished in 1/16" diameter—3/8" shank in the two-flute series.



Standard Long Neck

MELIN "LONG NECK" AND STANDARD THREE-FLUTE END MILLS GIVE YOU THESE SPECIAL ADVANTAGES:

1. **PERFECT BALANCE FLUTE DESIGN.** Scientifically designed flutes guarantee extra sturdiness and more efficient chip disposal—eliminates flutter, chatter and excessive spindle strain at high speeds—permits roughing and keyway milling to be done within closer limits and with a smoother finish.

2. **MORE EFFICIENT CUTTING EDGE.** The combination of first and second back offs provides stronger, keener, longer lived cutting edges. Hollow ground flutes permit faster, cleaner cutting with minimum heat generation—all decarburized metal ground off.

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4. **GUARANTEED CONCENTRICITY.** Concentri-matic Machine—another Melin exclusive—makes eccentricity impossible.

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Magnetic Thickness Gage

A magnetic gage for measuring the thickness of thin coatings on steel was developed at Frankford Arsenal, Philadelphia, during the war. Essentially, the device consists of a solenoid containing a soft, movable iron core and is equipped with a suitable indicator scale. An alternating current is used to energize the solenoid.

In operation, the solenoid is placed over the steel coating, so that its iron core is magnetically attracted to the coating. The core is then lifted to a "critical" position, at which the attraction of the solenoid for the core will just overcome that of the steel. The "critical" position varies with the thickness of the coating. The operator takes a reading from the indicator scale at this point.

Voltage variations within reasonable limits did not affect the accuracy of the instrument. The maximum error of the device ranged from plus or minus five percent for films 0.002 inch thick, to plus or minus three percent for thicker coatings.

G.E. Metallurgy Division

Further expansion of the General Electric Chemical Department with the formation of a metallurgy division with Pittsfield, Mass., headquarters has been announced by Dr. Zay Jeffries, Company vice-president and general manager of the Chemical Department.

The new division, representing the third operating unit to be incorporated in the Chemical Department, will handle the sale of various types of permanent magnets and metallurgical products. Principal among these is the permanent magnet material known as alnico, an alloy containing iron, nickel and aluminum as essential ingredients, and generally also cobalt, which alloy is used extensively in motors and generators and which has made possible new designs of precision equipment. Another important product is vectolite, the first non-metallic, non-conducting magnet material ever made. Metallurgical products include fernico, genelite, tungsten boats and precision castings.

Dr. Edgar C. Bain Awarded 1946 Honors

The American Society for Metals has announced that Dr. Edgar C. Bain has been awarded the Albert Sauveur Achievement Award for 1946. Dr. Bain is vice president in charge of metallurgy and research of the Carnegie-Illinois Steel Corporation, Pittsburgh, Pennsylvania. Formal award of the scroll and plaque will be made on November 21st at the American Society for Metals' annual banquet, held as part of the National Metal Congress and Exposition at Atlantic City, N. J.

This year's award was made on the basis of the recipient's conception of a new approach to the heat treatment of steel. The citation states that "prior to the work of Bain, relatively little was known about the mechanism of the hardening of steel. True, people had known from earliest times that steel, having been heated to an elevated temperature, would become soft if cooled slowly and would be hard if cooled rapidly. When the microscope was applied to steel, it was learned that the soft material was characterized by a microscopic structure called pearlite while the structure of the

hard material was called martensite. But as to precisely how and exactly when these structures formed, very little was known."

"Dr. Bain conceived the idea that the mechanism of heat treatment might become known if each step in the cooling was investigated, examining the product formed at each temperature level during cooling. This concept was not so simple as it may seem, for it involved the additional realization, until then unknown, that at each temperature level the transformation occupied time and that the product could therefore be studied as it formed . . . ."

The purpose of the Sauveur Award is "to recognize a metallurgical achievement which has stimulated other organized work along similar lines to such an extent that a marked basic advance has been made in metallurgical knowledge." Further, "awards are made only after the pioneering work has proven by time to have conformed to the purpose for which the award is made."

Quality Control Conferences

The first of a series of two Conferences on Quality Control and closely allied topics was held at the Providence, R. I., plant of Federal Products Corporation, August 13th to 16th inclusive. A second Conference is planned for September 10th to 13th. These Conferences were sponsored at this time to meet a growing demand for authoritative discussion of the subject, so vitally related to the needs of industrial production now, and in the immediate future. The specific purpose of the August Conference was to demonstrate, under actual practical factory conditions, just how and where Quality Control, Statistical Methods, Gaging and Inspection was made to play. The program included a practical description of the statistical technique and profitable applications of Quality Control. The Shop Use of Acceptance Sampling, Sequential Sampling, Per Cent Defective Methods of Scrap Control, Batch and Chart Control, Visual 100% and Patrol Inspection was also discussed. A new and most important section of the program was a period devoted to gage design, a subject heretofore held in the hands of experts.

Gaging by the various mechanical, indicating, electric and electronic methods was also shown. The management aspect of Quality Control, including Training Cost and Justification angle was also dealt with. The series of discussions were led by specialists, selected as particularly competent in their respective fields.

Members of the Sales Engineering Staffs of Pratt & Whitney Co., Hartford, and Taft-Peirce Mfg. Co., Woonsocket, R. I., will collaborate, together with the following: R. A. Cotter, Quality Control Engineer, U. S. Time, Inc., Waterbury, Conn., W. R. Purcell, Quality Control Manager, Sylvania Electric Products, Salem, Mass., C. J. Hudson, Quality Manager, The Norton Co., Worcester, Mass., John Greacen, Chief Inspector, The Bristol Co., Waterbury, Conn., C. J. Kirchen, Statistician, Remington Arms Co., Bridgeport, Conn., Fred Stone, Director of Engineering, Wanskuck Mills, Providence, R. I., and Dr. J. M. Juran of Wallace, Clark Co., and New York University.

Low Temperature Properties of Ferrous and Non-Ferrous Alloys

Comprehensive data on the low-temperature properties of ferrous and non-ferrous metal alloys, based on information available as of September, 1941, are contained in a 591-page report now on sale by the Office of Technical Services, Department of Commerce. The data were compiled by A. E. White and C. A. Sibert of the University of Michigan under a wartime contract with the National Defense Research Committee.

A general summary of the investigators' main observations is contained in the report and the following are some of their conclusions:

1. The physical properties of non-ferrous materials at room temperatures are either maintained or improved at subzero temperatures.
2. Ferrous materials increase in hard-

ness, tensile strength, and yield point at sub-zero temperatures, but show a decrease in value for reduction of area, elongation, and impact resistance.

3. The transition temperature from a tough to a brittle type of fracture is not constant with alloys of the same type and varies even with materials of substantially the same composition. Among the factors which appear to affect the transition temperature are the grain size of the material, the carbide size and distribution, the size and distribution of non-metallic particles, the size of sample and type of notch, and the type of impact testing machine.

4. The most outstanding element which aids in maintaining good impact resistance at low temperatures is nickel. Copper is beneficial, but not so satisfactory as nickel.

5. In general, it appears that any element which will form a solid solution when combined with ferrite tends to improve low-temperature resistance, while any carbide forming element, in the presence of substantial amounts of carbon, tends to decrease low-temperature impact resistance, according to the investigators.

The report comprises seven volumes of data, classified into two main sections, non-ferrous metals and alloys, and ferrous alloys. Each group is divided into several sub-groups according to alloy types. Composition, heat treatment, tensile test data, impact properties, and other relevant data are given for the alloys considered. An index is provided.

German Light Metal Industry Report

Semi-continuous casting of rolling and extrusion stock was highly developed by the German light metal industry during the war, according to a 31-page report now on sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C. Another major development in the German industry was the use of electrical resistance furnaces in combination with induction melting.

This report on German technique in the production of light alloys was prepared by Dr. P. M. Haenni of the Canadian Military Headquarters and T. J. Peake, Superintendent of Technical Applications of Metals, Ministry of Supply, for the British Intelligence Objectives Sub-Committee.

The most commonly used semi-continuous casting method was the "Wasserguss" (water spray) system, developed by the Vereinigte Leichtmetallwerke, in Hanover. A water-jacketed aluminum or copper mould, with a movable bottom mounted on a hydraulic ram, was used to make metal bars. As the metal solidified, the ram moved downward and the bar emerged from the mould. The bars were cooled by water running through the water jacket and then passing through holes or slits in the bottom of the mould. Further cooling was obtained by passing the bar into the tank containing circulating water.

Another type of water-jacketed mould, with a movable wall, was used for semi-continuous casting of narrower ingots. The movable wall was raised gradually as the liquid metal was poured into the mould.

In most aluminum alloy producing plants in Germany, melting was done in induction furnaces with an inclined hearth, permitting the metal to run down to the cooler part of the furnace as it melted. Metal was transferred from the melting to the holding furnaces by gravity or suction. The holding furnaces usually were of the electric resistance tilting type.

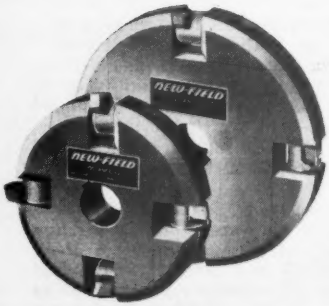
Other major developments in the German light metal industry were the rolling of tapered section sheet for aircraft and electrolytic refining for scrap recovery.

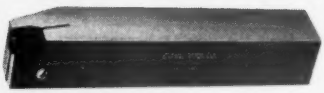
The Germans lagged behind the Allies in the use of high-strength, artificially aged aluminum alloys for aircraft; in brazing of aluminum alloys; rolling of propeller blades; and in the use of high-purity, heat-treated aluminum casting alloys, according to the investigators.

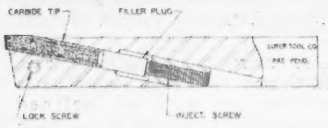
The report covers German processes for reducing aluminum, casting ingots, manufacturing aluminum and magnesium alloy castings for engine components, and for producing alloy sheet, extrusions, tubes and forgings.

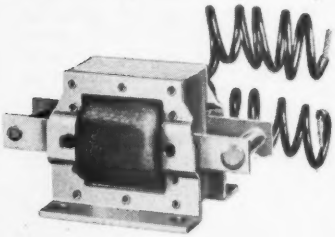
PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS









FOR FURTHER INFORMATION FILL IN KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT

FLY CUTTING, SLOTTING, FLAT SURFACING, STRADDLE MILLING, GEAR CUTTING, FORM MILLING AND BORING are operations performed by the New-Field Universal Fly Cutter. Each of the cutters can be set in any of a wide range of positions and is locked by a single screw. Therefore, complicated cuts are broken down into simple patterns by grinding and setting each bit for a portion of the cut. The job is then run with one setup. Complete detailed information will be furnished by the NEW-FIELD MACHINED PARTS CO., Dept. 54, 549 W. Randolph St., Chicago 6, Ill., or use INFORM-A-GRAM Key No. A54-P.

EJECTOR TYPE CARBIDE TOOL is made up of a holder and an insert bit of solid carbide which is held in place mechanically and can be quickly replaced with a new one. It is designed to eliminate all outside holding mechanism which frequently interferes with the flow of chips. This large insert carbide bit can take deep cuts and heavy feeds. The bits are easily ejected for regrinding, and being long, permit many regrinds, give excellent tool life, and low production costs. Literature is available from SUPER TOOL COMPANY, Dept. 1-68, 21650 Hoover Rd., Detroit 13, Mich. INFORM-A-GRAM Key No. 168-P.

ACTUATING PILOT VALVES and other control structures smoothly and efficiently, is the function of the new Barnes Midget size Solenoid. This sturdy instrument has been tested at 64 actuations a minute, hour after hour, for six months and was operating smoothly and efficiently at the end of this period. Complete information and engineering data will be sent on request from JOHN S. BARNES CORP., Dept. 38, Rockford, Ill., or use INFORM-A-GRAM Key No. A38-P.

EFFICIENT GRINDING, LAPPING, AND POLISHING with diamond compounds is dependent on the diamond particles being uniformly graded. As all diamond particles, regardless of size, have approximately the same number of cutting points, the smallest size consistent with the job is the most economical. Hyprez Diamond Compound is uniformly graded and packed in pyrex cartridge tubes with syringe applicator. Complete data will be sent on request from the ENGIS EQUIPMENT CO., Dept. 9-39, 431 South Dearborn St., Chicago 5, Ill., or use INFORM-A-GRAM Key No. 939-P.

ON PARADE

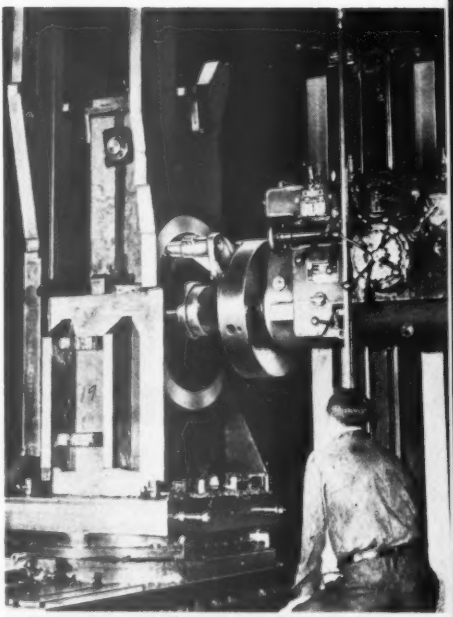
A VARIETY OF BORING, TURNING, GROOVING, PROCESSING AND THREADING OPERATIONS, difficult to handle on ordinary equipment, are simplified by the continuous feed facing and boring head manufactured for use on Giddings & Lewis horizontal boring machines. The attachment proves unusually helpful in machining work pieces which are large and cumbersome and which cannot be easily reset. Complete details on this facing and boring head will be sent on request from GIDDINGS & LEWIS MACHINE TOOL CO., Dept. 43, Fond du Lac, Wis., or use INFORM-A-GRAM Key No. 43-P.

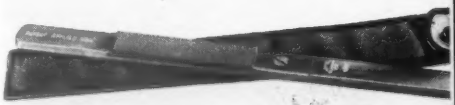
LIGHT WEIGHT CARBIDE FILE with aluminum holder can be used for filing bronze, brass and hardened steels. The filing surface of this tool is a carbide insert, 4" long by ¾" wide, and is single cut with 34 teeth per inch on the same angle as standard mill files. The tool has been designed primarily for deburring or chamfering hardened steels which must be operated at speeds of 450 fpm on turret or engine lathes. It cannot be used for hand filing of metal. Additional information is available from CARBOLOY COMPANY, INC., Dept. 82, 11109 E. 8 Mile Road, Detroit 32, Mich. INFORM-A-GRAM Key No. 82-P.

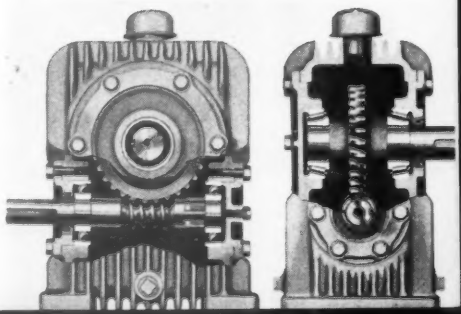
EFFICIENT SPEED REDUCTION is accomplished by the new compact speed reducers, built around double enveloping Cone-Drive gearing, announced by Michigan Tool. The increased horsepower and torque they will transmit for a given size, is due to the Cone-Drive gearing, which has more teeth in contact and more contact per tooth than other types of right angle reduction gearing. Complete details on these speed reducers may be had from MICHIGAN TOOL CO., Dept. 47, 7171 E. McNichols Rd., Detroit 12, Mich., or use INFORM-A-GRAM Key No. 47-P.

PLUNGING INTO METAL OR PLASTICS AND MILLING IN THE SAME OPERATION is done with the new carboloy tipped end mill developed by Nelco Tool Co. In exhaustive tests by Nelco engineers, milling a "Keyway", the 3-flute end mill finished the job smoother and in one-sixth the time consumed in milling the same piece with a high-speed end mill. This end mill will work in alloy steel, cast iron, brass, bronze and plastic material. For full details write THE NELCO TOOL CO., INC., Dept. 72, 370 Hamilton Ave., Brooklyn 31, N. Y., or use INFORM-A-GRAM Key No. E72-P.

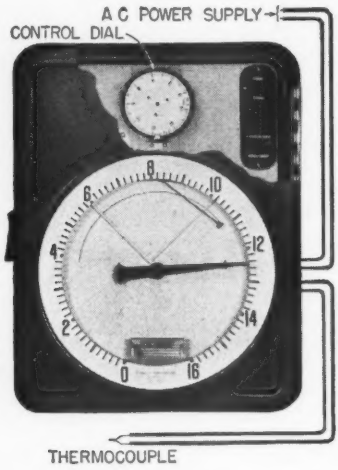
DIFFICULT TEMPERATURE CONTROL PROBLEMS are simplified through a new electronic type recorder-controller which continu-



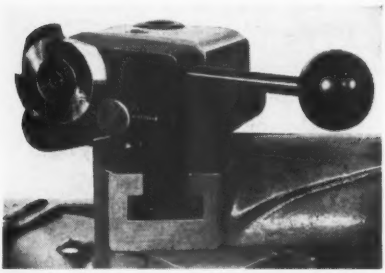




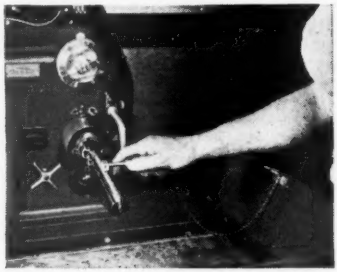
ously records one or two temperatures on a 24 hour circular chart. In designing the Bailey Pyroton Potentiometer Pyrometer, continuously moving or vibrating parts have been eliminated from the measuring system, thus insuring trouble free service. This instrument is described and illustrated in Bulletin 232, available on request from BAILEY METER CO., Dept. 9-54, 1050 Ivanhoe Rd., Cleveland 10, Ohio, or use INFORM-A-GRAM Key No. 954-P.



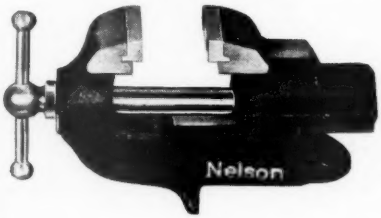
FOULK RETRACT-A-TOOL holders are now made in two extra sizes which accommodate an unusual formed threading tool for external thread chasing. Shown herewith is a No. 1 size Retract-A-Tool mounted with one of these four cutting edged, formed threading tools. The Retract-A-Tool automatically snaps the tool away from the work at the end of each threading cut at precisely the same point. This allows increased spindle speeds without danger of the tool digging into the work at the thread ending. Descriptive literature is available by writing FOULK ENGINEERING CO., Dept. 82, 4208 Airport Rd., Cincinnati 26, Ohio, or use INFORM-A-GRAM Key No. C82-P.



DRESSING PRODUCTION HONING STONES to keep them at their top-cutting efficiency is facilitated by a new diamond dressing tool announced by Sunnen. This new dresser quickly breaks the glaze and restores cutting action without wearing the stone out-of-true or fracturing the bond. Detailed information will be sent on request from SUNNEN PRODUCTS CO., Dept. 5-83, 7947 Manchester Ave., St. Louis 17, Mo., or use INFORM-A-GRAM Key No. 583-P.



HOLDING SMALL PARTS, such as instruments, is facilitated by a new small adjustable precision vise recently announced. Unlike the ordinary vise in which the front jaw moves, the Nelson Precision Vise has the front jaw stationary and only the rear jaw moves. The vise can be secured to a work bench or it can be held in the hand with the work in place, as it weighs only one pound. Complete details will be furnished by FORTUNE MFG. & SALES CO., Dept. 19, 4221 Beverly Blvd., Los Angeles 4, Calif., or use INFORM-A-GRAM Key No. J19-P.



PRESSURE-COMPENSATING PACKING RINGS. The tendency of some types of "V"

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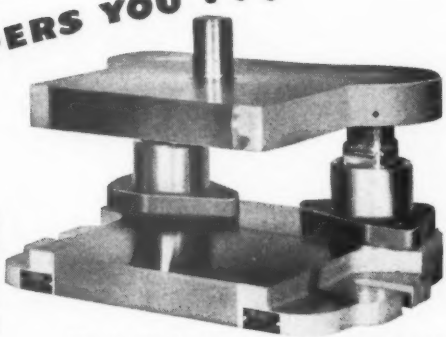
NEW SPEED and ACCURACY WITH MICROLEX ANTI-FRICTION DIE SETS • • •



Microlex Die Sets have ball or roller bearing guide pins which reduce die setter's time . . . enable you to get into production quicker . . . permit fast press speeds. Microlex Die Sets eliminate all down time caused by bound, scored or galled pins. Bearings have pre-load of .0015" to prevent play between guide pins and bushings.

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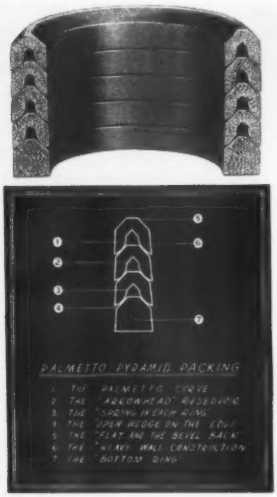
DSCO

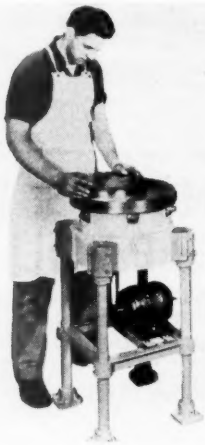
shaped packings to weaken and split at the "hinge" has been overcome by a new design which includes heavier wearing surfaces and other innovations. The bottom ring receives the full impact of the pressure on the power

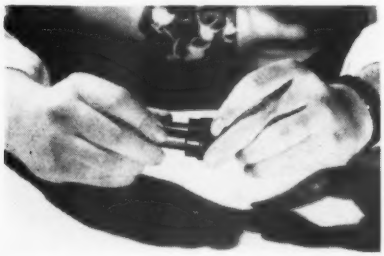


stroke. This ring expands the wedge-shaped lip of each ring above so that the packing is pressed against both rod and side walls, effectively preventing leakage. Complete details may be requested from GREENE, TWEED & CO., Dept. 7-82, Bronx Blvd. at 238th St., New York 66, N. Y., or use INFORM-A-GRAM Key No. 782-P.

SEAL-PEEL "Tailor Made Packaging" is a new packaging material now in use by many major industrial concerns for packaging precision tools, spark plugs, cutting tools, and many other products. It is chemically engineered to meet specific needs of the individual manufacturer, so that his product is delivered in as perfect condition as when it passed final inspection. The illustration shows a gage dipped in Seal-Peel at the Jansson Gage Co., Detroit. Their experience shows their tools dipped in this material are protected against rust and corrosion, and to a considerable extent against damage from dropping or being struck. For further information and literature, write SEAL-PEEL, INC., Dept. TJ, 903 Hammond Bldg., Detroit 26, Mich. INFORM-A-GRAM Key No. G35-P.

HIGH SPEED PRECISION FLAT LAPPING of single pieces or production runs of hardened steel, quartz, and glass, is the purpose for which this Spitfire flat lapping machine was designed. The machine finishes each piece to a high polish with a possible surface finish as fine as 2 rms micro-inches. Requests for further





information or for an engineering analysis of flat lapping problems should be directed to SPITFIRE TOOLS, INC., Dept. 98, 2933 N. Pulaski Rd., Chicago 41, Ill., or use INFORM-A-GRAM Key No. E98-P.

A MIDGET PLASTIC TANK, conveniently portable for the plastic coating of plugs, gages, carbide tipped tools, etc., is now marketed by AEROIL PRODUCTS CO., Dept. TD, West New York, N. J. In this tank the full compound "load" temperature is increased from a cold start to dipping temperature within "minutes" instead of hours.

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"KNOW HOW"
DEVELOPS
BETTER
SPRINGS

—utilizing new and old materials in new designs to save space and weight—often with increase in spring life, capacity and efficiency.

Range of effective usages has been considerably increased. More intricate shapes and bends are now possible. Heat treatment and heat setting have been greatly refined. *Investigate!*

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With this holder there is no need to grind outside diameters. Saves time in assembly. Rings are quickly and easily replaced. Light in weight . . . about half the weight of ordinary gages.

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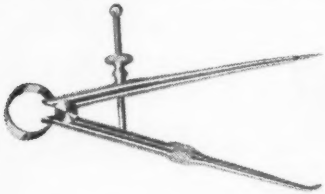
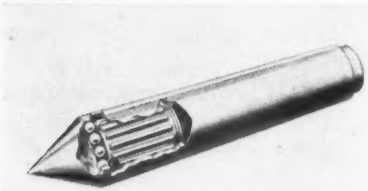
It also features a neon pilot light for swift visual checking and a cover which is easily removed with an insulated plastic handle. INFORM-A-GRAM Key No. 776-P.

NORK HERMAPHRODITE CALIPERS, No. 600, featuring round legs and stiff springs, are introduced by NORK PRODUCTS CO., Dept. DJ, 5897 South Main St., Los Angeles 3, Calif. This caliper also incorporates a spool and leg assembly of tapered fit. Like those used in



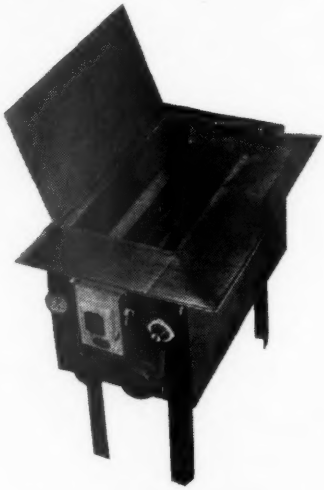
other Nork quality tools, the scribing point is easily replaceable. Precision made and highly polished, Nork Hermaphrodite Calipers No. 600 are available in either the 4" or 6" size. INFORM-A-GRAM Key No. 989-P.

STAR LIVE CENTERS, sturdily and compactly constructed without overhang and having



the same general dimensions as standard dead centers, are now marketed by SAMUEL S. GELBER CO., Dept. 58, Chicago 6, Ill. The Star Live Center embodies a high grade alloy tool steel spindle hardened to 64 Rockwell and precision ground. Its thrust type ball bearings and radial roller bearings are all ground and turn on an anti-scoring concentrated lubricant which withstands pressure greater than 50,000 lbs. psi. Write the company for detailed information, or use INFORM-A-GRAM Key No. H58-P.

ELECTRICALLY HEATED WAX DIPPING TANK speeds wax dipping and rust proofing



operations. Thermostat control assures accurate temperature at all times, preventing overheating or discoloration of the wax. Sizes range from 5 gallon to 300 gallon capacity. Further details may be obtained from D. C. COOPER COMPANY, Dept. 89, 1467 So. Michigan Ave., Chicago 16, Ill. INFORM-A-GRAM Key No. G89-P.

PNEUMATIC THREE-WAY PILOT VALVES for use with controlled air powered machine tools have lately been introduced. One such compact valve shown herewith is only 3¼" long with a fully extended piston. Used normally open or closed as either a three-way or two-way valve with one port plugged, the CRV valve serves in the operation of air cylinders, motors, controls, and single acting cylinders which equip air vises and chucks. Information on the application and operation of these valves will be furnished on request

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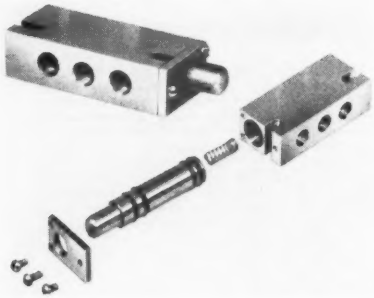
PROGRESS ON PARADE



from the MODERN PRODUCTS, LTD., Dept. 59, 952 So. Grand Ave., Los Angeles 15, Calif., or use INFORM-A-GRAM Key No. H59-P.

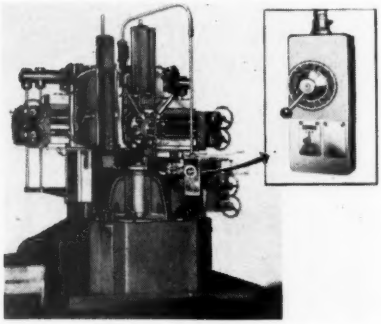
RESINOID-BONDED DIAMOND ABRASIVE WHEELS designed particularly for sharpening carbide tools are announced by THE WICKMAN CORPORATION, Dept. 5-26, 15533 Wood-

row Wilson Ave., Detroit 3, Mich. These American made wheels duplicate in design the Wickman originated diamond wheels made in England for the past ten years and in Wickman's Canadian plant for a number of years. They will be marketed through a nation wide distributor organization. Additional details are available upon request, or use INFORM-A-GRAM Key No. 526-P.

SAFER CUT-OFF WHEELS provide for greater than usual speed and free cutting action while lessening wheel breakage in non-ferrous metal cutting. They are shown here with and are available from BAY STATE ABRASIVE PRODUCTS CO., Dept. TD, 2-05 Union Street., Westboro, Mass. Their entirely

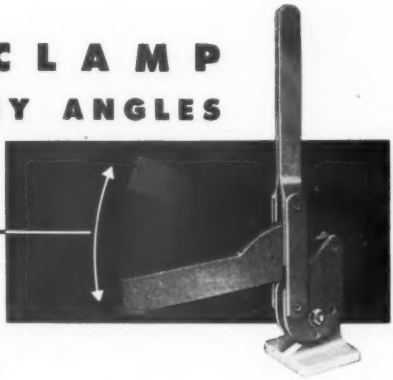
new cotton fibre abrasive bond renders these wheels extremely flexible for both side grinding and close following of contours in cutting. Complete information will be sent on request from the company, or use INFORM-A-GRAM Key No. 205-P.

PENDANT CONTROL of Bullard Cut Master Vertical Turret Lathes affords them a highly accurate means of regulation as well as operating efficiency. The pendant is mounted on a swinging arm surmounting the



machine and may be swung from either side of the machine to the other side, thereby providing the lathe with full operating control at all times. This type of control differs from conventional ones in its rapid dialing speed selectivity. Detailed information is available from THE BULLARD CO., Dept. 2-20, Bridgeport 2, Conn., or use INFORM-A-GRAM Key No. 220-P.

This ONE CLAMP GIVES YOU MANY ANGLES OF CLAMPING



PROVIDES RANGE OF CLAMPING TO 45° WITH SAME MOUNTING

If you are required to clamp work at different angles from job to job, you should have a KS Model Knu-Vise toggle-action clamp—one of the most versatile clamps made.

By means of an ingenious tear-drop shaped sideplate this clamp permits change of toggle bar to any angle up to 45° without disturbing fixed base. Simply drill a hole in upright plate of base (through hole already provided) at required angle of toggle bar to work—then set with dowel.

Made in 3 sizes to meet wide range of applications—accommodating pressure loads from 650 to 1200 pounds.

KNU-VISE INCORPORATED

1330 PLUM ST. DETROIT 16, MICH.
4328 SAN FERNANDO RD. GLENDALE, CALIF.

Hundreds of Industrial Plants have

CUT GAGE COSTS

with **SCHNACKE *Adjustable***

FLUSH PIN GAGE

With this new adjustable gage, you can have an accurate Flush Pin Depth Gage quickly and save time and money. Serves many varied gaging purposes in production and inspection. Set consists of 3 interchangeable depth rods (1"—2"—3") and 1" diameter sliding anvil, adjustable to required depth. Sliding tolerance feelers at the top are set with micrometer screw from plus or minus .000 to .200. Locks firmly. Standard set applicable to any decimal dimension up to 3.00".

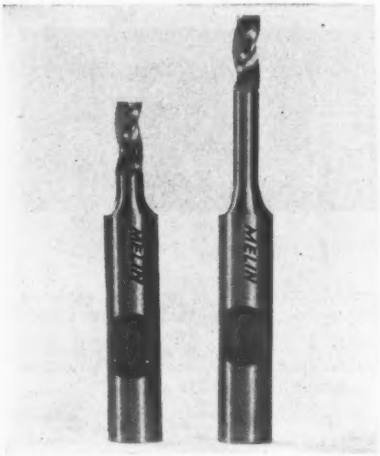
Special anvils and longer rods are also available. Write for descriptive circular.

SCHNACKE, INC.

1816 E. Columbia St. Evansville, Ind.

PROGRESS ON PARADE

MILLING DEEP CAVITY WORK is facilitated by the new long neck end mills recently announced by Melin. Long life at high speeds and greater accessiblity to hard-to-reach cavities feature this addition to the

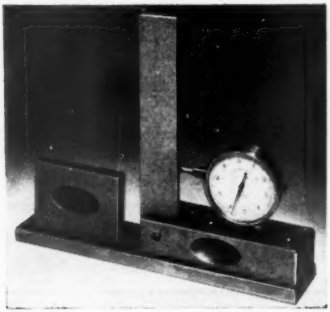


Melin line of standard and special metal cutting tools. Created to fill a definite need, these tools are available in the standard bottom cutting, ball, and radius ends. Full information will be sent on request from MELIN TOOL CO., INC., Dept. 1-09, 1331 Phillips, S. W., Grand Rapids 7, Mich., or use INFORM-A-GRAM Key No. 109-P.

EIGHT DIFFERENT METAL-WORKING OPERATIONS can be performed on the new Thomas

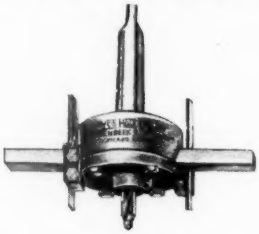
8-in-1 Metal Master. This completely portable machine can be used for metal disintegration, arc welding, brazing, soldering, drill pulling, air extraction, metal etching and demagnetizing operations in tool and die rooms, tool salvage and maintenance departments, and on production lines. Descriptive literature is available on request from the CLINTON MACHINE CO., Dept. 35, Clinton, Mich., or use INFORM-A-GRAM Key No. C35-P.

ACCURATELY CHECKING RIGHT ANGLES and accuracy of work within .0001" within a given distance is simplified with the Micro-Sine Square. A standard indicator instantly shows error on the indicator dial and shows where and how much correction is required.

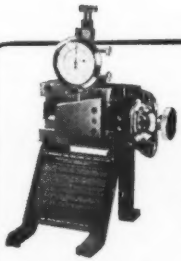


It provides a standard for checking master squares, tri-squares and tools as well as jobs. For complete details write to ACRO TOOL AND DIE WORKS, Dept. 595, 4554 Broadway, Chicago 40, Ill., or use INFORM-A-GRAM Key No. 595-P.

CUTTING HOLES AND WASHERS from steel plate up to ½" thick and from 4½" to



10" dia is the function of a new heavy duty washer cutter. Clean round holes are as accurately cut to size as if done with a boring tool. Detailed information may be had by addressing WYZENBECK & STAFF, INC., Dept. 5-33, 838 West Hubbard St., Chicago 22, Ill., or use INFORM-A-GRAM Key No. 533-P.



CLARKATOR CHECKS DIAL INDICATORS

CLARK

Gives Continued Accuracy, Rapid Measurements

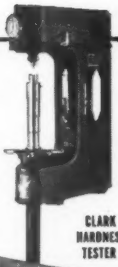
THE CLARK has everything you want in a hardness tester—direct reading precision dial, durable construction, ease of servicing. Three standard models shipped complete with weights, dust protectors, diamond and steel penetrators, test blocks, and anvils.

CLARKATOR CHECKS DIAL INDICATORS with micrometer speed and sine bar accuracy. Easy to operate—just four simple steps. Complete instructions permanently fastened to base.

MASTER DIAMOND CHECKING SET

MASTER DIAMOND CHECKING SET eliminates hardness tester errors. Consists of a master diamond penetrator and two test blocks. Precision is assured over a long period because the set is used only for checking. Furnished in leather case.

Learn the truth about hardness testing! This 20-page reference manual (right) contains information on history, theory, practice, and equipment for modern hardness testing. Available to executives without charge. Write Dept. MMS today!



CLARK HARDNESS TESTER

CLARK INSTRUMENT, INC.

10200 Ford Road. • Dearborn, Mich.

Ruggedly designed!

Features:

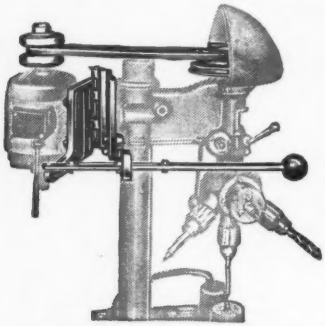
- Strong heavy bevel for extra biting strength
- Scientifically rounded head to prevent splitting

The ACROMARK *Company*

5-15 MORRELL STREET, ELIZABETH 4, NEW JERSEY

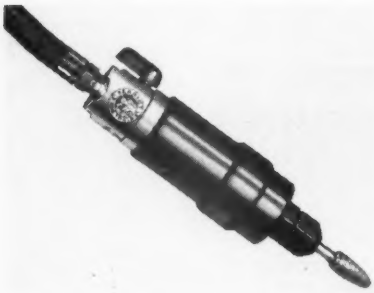
PROGRESS ON PARADE

OBTAINING CORRECT DRILLING AND TAPPING SPEEDS on all drill presses is the purpose of the new Speed Changer just announced by Chicago Drillet. After the Speed Changer has been set for the range



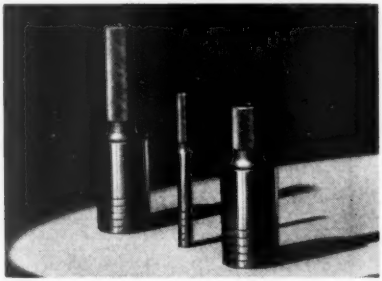
of speed desired, the touch of a lever will give the press speed required. A standard four-step cone V-belt pulley will have a speed range from 435 to 4550 rpm. Full details on this Speed Changer will be sent on request from the CHICAGO DRILLET CORP., Dept. 34, 1729 N. Winchester Ave., Chicago 22, Ill., or use INFORM-A-GRAM Key No. B34-P.

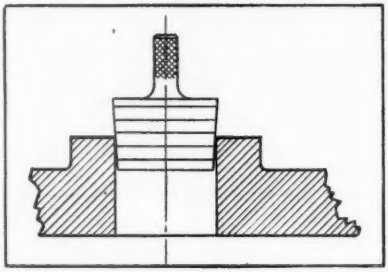
BURRING, GRINDING, POLISHING, BUFFING, DRILLING, MILLING, ROUTING, CARVING, AND MIXING can be performed with the Ferriot "Powermax" Air Tools. Equipped with "Powermax" Rotary Files, ground from solid Tan Tung, provides a combination of



great versatility for a wide range of applications for either hand or machine mounted applications. For full details and specifications write FERRIOT BROS., INC., Dept 35, Akron 5, Ohio, or use INFORM-A-GRAM Key No. J35-P.

RAPID VISUAL CHECKING OF HOLE SIZES in jig boring, internal grinding, inspection, tool and stockrooms is performed with the Detail Tapered Pass Gage. The taper of the gage is so designed that the entering end is .005" under normal dimensions and each succeeding circumferential line represents an increase of .001" in diameter progressively to the finish size. These indicating lines are



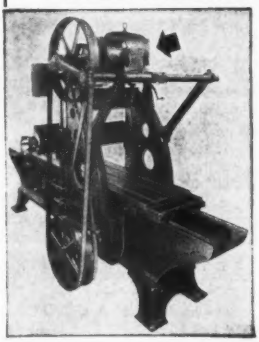


1/8" apart making visual reading simple and easy. For detailed information write DIEMAKER SUPPLIES CO., Dept. 36, 2679 East Grand Blvd., Detroit 11, Mich., or use INFORM-A-GRAM Key No. J36-P.

ADJUSTING AND SECURING the Precision Swivel Vise is accomplished in a single movement. Setting the vise to any required angle is facilitated by a dial located in the center of the table on which the Gardner Floating Jaw moves. This type of jaw gives instant gripping on the workpiece. Complete details on these vises are available on request from MACHINISTS TOOL CO., Dept. 37, 2830-

2836 West Lake St., Chicago 12, Ill., or use INFORM-A-GRAM Key No. J37-P.

MASTERDRIVES FOR PLANERS



Eliminates Lineshafting

Now you can have added flexibility in plant layout, because Masterdrive eliminates lineshafting and permits placing planers wherever you wish.

The drive is supported by four supports. Each of these require the drilling and tapping of four holes. Once supports and horizontal bars are in place, motor base and outboard bearing support can be moved laterally to line up with pulleys. Your present ceiling lineshaft pulleys are used on the motor countershaft.

A single complete installation with Masterdrive—one responsibility. Over 1200 Drive Specifications—name your machine—we'll motorize it. Write today.

MASTER **THE MASTER ELECTRIC CO.**

INDUSTRIAL EQUIPMENT DIV., DAYTON, OHIO

Machine Drives • Electric Hoists • Electric Hammers • Engine Driven Generator Plants
Portable Grinders • Big 3 (Power, Tool Operation, Concrete Vibration) Units • Tampers

FROM ONE JOB TO ANOTHER WITH "THE GREATEST OF EASE"

Because of its fast setup and easy changeover, the Linley Miller and Jig Borer does small jobs on dies, jigs, fixtures, patterns and models profitably . . . saving larger machines for more comprehensive operations.

Linley also provides . . . 8 spindle speeds to 4250 rpm; direct micrometer setting; grease-sealed bearings and anti-backlash in quill travel. Needs only 18½" x 20" floor space and has ample (7" x 17½") table size.

Try this time-saver, money-maker . . . now.

Bulletin on request.

LINLEY BROTHERS COMPANY
662 State St. Extension
Bridgeport 1, Connecticut

PUBLICATION PREVIEWS

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Use our postage-free Inform-a-Gram for your request

CAN BACKSTANDS BOOST GRINDING AND FINISHING PRODUCTION is discussed in a new brochure, "Production Talks Backstands", issued by Behr-Manning. Seven case studies are taken from diversified industries on belt grinding and finishing with idler backstands. Full specifications are given in each study and comparisons made with former methods employed. Copies of this brochure will be sent on request by BEHR-

MANNING CORP., DIVISION OF NORTON CO., Dept. 1-10, Troy, N. Y., or use INFORM-A-GRAM Key No. 110-P.

TESTING AND CALCULATING THE STRENGTH OF MATERIALS is simplified by a set of tables developed by the engineering staff of W. C. Dillon & Co. Three factors are involved, so that with two of them known the third can be determined. These factors are: tensile strength in psi; cross section area; and tensile strength in pounds for given area. The tables are incorporated in a new brochure which describes and illustrates the Dillon Universal Tester and the grips as accessories for testing different types of materials. Copies will be furnished on request from W. C. DILLON & CO., INC., Dept. 58, 5410 W. Harrison St., Chicago 44, Ill., or use INFORM-A-GRAM Key No. A58-P.

INCREASING LIFE OF LATHE AND GRINDER CENTERS by applying Colmonoy No. 6 tips is explained in a new folder by Wall Colmonoy Corp. These tips are cast to shape and then applied by silver soldering. In addition to supplying the center tips, complete retipping service on centers has been established. For copies of this folder write WALL COLMONOY CORP., Dept. 849, 720 Fisher Bldg., Detroit 2, Mich., or use INFORM-A-GRAM Key No. 849-P.

HOLDING WORKPIECES for drill press, lathe, milling, grinding and bench operations is simplified by the Munton Hydraulic Vise. It is built for speed, portability and strength and being foot operated, both hands are left free for loading the work. Illustrated literature describing this vise will be mailed on request from MUNTON MFG. CO., Dept. 10, 9400 Belmont Ave., Franklin Park, Ill., or use INFORM-A-GRAM Key No. J10-P.

HOLDING CUTTING AND BORING TOOLS in straight, right- or left-hand offset positions is accomplished by the American Tool Holder. A swivel head on the holder shank makes possible eight commonly used positions for either square or round shaped cutting tools. This holder is further described in literature available from EDWARD BLAKE CO., Dept. 79, 634 Commonwealth Ave., Newton Center 59, Mass., or use INFORM-A-GRAM Key No. 79-P.

MAKING MOLDS FOR CASTING PLASTICS, RUBBER AND OTHER MATERIALS from a new alloy, Moldaloy, has wide possibilities. It is also recommended for making wax molds for precision casting processes, models for engraving machines and many other operations of a similar nature. Detailed information on this material will be furnished on request by TRETHWAY ASSOCIATES, Dept. 20, 37 Wall St., New York, N. Y., or use INFORM-A-GRAM Key No. J20-P.

DIE SETS & DIE MAKERS SUPPLIES of every kind to adequately fill all requirements are obtainable from DETROIT DIE SET CORP., Dept. TD, 2895 West Grand Blvd., Detroit 2, Mich. In their Sixth Edition, 48-page catalog, are given complete descriptions and specifications of 16 standard model, either semi or all steel die sets. Besides stocking all these products, Detroit Die Set Corporation uses their complete flame cutting and welding

Yes! You Can ARC WELD *with the NEW Thomas* METAL MASTER

This Amazing Machine Gives You 8 Metal Working Operations in One Unit

1. DISINTEGRATION
2. ARC WELDING
3. SOLDERING
4. BRAZING
5. ETCHING
6. DRILL PULLING
7. DEMAGNETIZING
8. AIR EXTRACTION

$245.00 UP TO $895.00

NO TOOL SALVAGE ROOM IS COMPLETE WITHOUT A THOMAS

The famous THOMAS Metal Disintegrator that has saved so many thousands of dollars in tool salvage departments is now *more than just a disintegrator.* NOW, IT GIVES YOU 8 METAL WORKING OPERATIONS IN ONE MACHINE! . . . a complete salvage department in itself as well as an efficient production unit.

Now, more than ever, you will find that a THOMAS will save money, time and materials for you . . . now, more than ever, a THOMAS is a necessity in your tool die rooms, salvage department, and on your production line. No other machine will do as much for you for so small an investment as a THOMAS.

MAKE RESERVATION NOW FOR A DEMONSTRATION!

Clinton MACHINE COMPANY
CLINTON, MICHIGAN

CLINTON MACHINE COMPANY, Clinton, Mich.
Sure! We want to see what THOMAS' 8 Metal Working Operations can do for us in our own plant ☐
Send literature ☐

Name_____

Address_____

City_____ State_____

facilities to produce numerous sizes and shapes of all steel or semi-steel die sets. INFORM-A-GRAM Key No. 674-P.

MILLING CARBIDE STEEL on machines specially designed for this type of work is described in literature recently issued. Outstanding features of the machine include: an unusually powerful spindle drive motor cross-mounted in a sturdy column, the heavy flywheel which forms an integral part of the spindle, the feed motor mounted on the right side of the knee, and the climb cutting equipment which eliminates backlash in the table feed screw. Catalog CSM-20, describing and illustrating these machines, is available from KEARNEY & TRECKER CORPORATION, Dept. DJ, Milwaukee 14, Wis. INFORM-A-GRAM Key No. 592-P.

INFORMATION FOR THE STEEL BUYER, ENGINEER AND PRODUCTION MAN is contained in a new Steel Catalog and handbook under preparation. Three of the seven sections have been published. Subjects covered will be Cold Finished Carbon Bars, Cold Finished and Hot Rolled Alloy Bars, Turned and Ground Shafting, Tool Steels (including Tool Steel Tubing), Drill Rods, Spring and Shim Steel and The Bisco Data Book. For further information address the BISSETT STEEL CO., Dept. 603, 945 East 67th St., Cleveland, Ohio, or use INFORM-A-GRAM Key No. 603-P.

SELECTING THE PROPER RESISTANCE WELDING EQUIPMENT for specific welding jobs is described and illustrated in WType Bulletin 2-413 by Taylor-Winfield. It covers the proper machine for fabricating boxes, panels, frames, racks, automotive parts and many others of carbon and stainless steels, and weldable alloys of nickel and copper. Copies will be sent on request from THE TAYLOR-WINFIELD CORP., Dept. 75, Warren, Ohio, or use INFORM-A-GRAM Key No. G75-P.

PRECISION BORING OF STEEL PARTS is facilitated by small tools made from a new Kennametal hard composition, Grade K5H. It has a Rockwell A hardness of 93.2, great resistance to cratering, and is unusually strong for such hard material. Full details concerning this material will be sent on request from KENNAMETAL, INC., Dept. 33, Latrobe, Pa., or use INFORM-A-GRAM Key No. 33-P.

PAINTING BY THE ELECTROSTATIC SPRAYING AND DIPPING METHOD is explained and illustrated in new literature by Ransburg. Workpieces travel on conveyors through an electrostatic field created by 85,000 v to 100,000 v of pulsating dc. A supply of paint particles is introduced at low velocity into the electrostatic field, which pick up the same electrical charge and therefore are electrically attracted to the grounded articles on the conveyor. Copies may be obtained by writing HARPER J. RANSBURG CO., Dept. 5, Electric Coating Div., 1200 Barth Ave., Indianapolis 7, Ind., or use INFORM-A-GRAM Key No. E5-P.

READING MACHINE SPEEDS far removed from the operating machine is accomplished through the "Panel Type" Tachometer built by Ideal. A small electrical generator with a permanent "Alnico" magnet rotor is mounted on the machine, while the indicating instrument can be panel mounted. Complete details are given in literature available from IDEAL INDUSTRIES, INC., Dept. 30, 5186 Park Ave., Sycamore, Ill., or use INFORM-A-GRAM Key No. H30-P.

PRODUCING TOOL STEELS by the Armstrong Method is explained in new literature by Jessop. It deals with the Type "R" Tool Steels which is an excellent example of the application of composite metal to a job requiring the combination of hardness and edge holding properties of a high alloy steel with the toughness and machinability of a low alloy steel. Copies are available from JESSOP STEEL CO., Dept. 2-59, Washington, Pa., or use INFORM-A-GRAM Key No. 259-P.

VERTICAL MILLING OF IRREGULAR CONTOURS can be performed on the Wade Bench Profiler. It is designed to do a wide range of profiling, milling, slotting, recessing and routing operations on a variety of small parts. Literature recently issued describes and illustrates the machine and typical applications. Copies are available on request from THE WADE TOOL CO., Dept. 94, 49 River St., Waltham 54, Mass., or use INFORM-A-GRAM Key No. H94-P.

AUTOMATICALLY FORMING SHAPES AND BALLS from round rods of plastic materials on a formed abrasive wheel is made possible through The Automatic Abrasive Forming Machine and Centerless Grinder developed by Engineering Laboratories. Forming, centerless grinding and cutting off operations can be performed on this machine. For detailed information write ENGINEERING LABORATORIES, INC., Dept. 22, Colfax & West Oakland Avenues, Pompton Lakes, N. J., or use INFORM-A-GRAM Key No. T22-P.

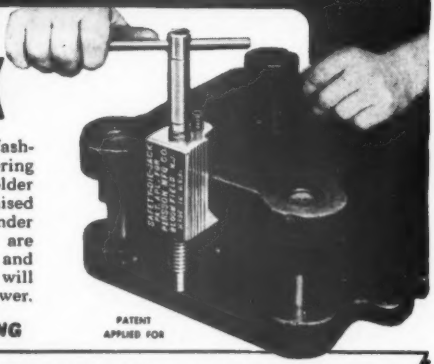
GRINDING JOBS REQUIRING MOUNTED WHEELS AND POINTS are made easier through the two utility sets developed by Bay State. The sets consist of 12 and 20 pieces, each providing the wheels and points most frequently used in the shop, with sizes and shapes for every job, and special shapes for hard-to-get-at places. Literature describing these sets is available on request from the BAY STATE ABRASIVE PRODUCTS CO., Dept. 2-05, Westboro, Mass., or use INFORM-A-GRAM Key No. 205-P.

FASTER, ACCURATE SAWING is possible with the new power saw just announced by

NOW YOU CAN SEPARATE AND ASSEMBLE DIE SETS..QUICKLY..EASILY..SAFELY!

with a PERSSON

DIE JACK



These Die Jacks eliminate old-fashioned, unsafe, prying or hammering methods. Just clamp on punch holder and turn handle. Punch holder is raised or lowered smoothly, always under control. PERSSON Die Jacks are precision built from fine steel and alloys—a tool every tool maker will want for his tool box or bench drawer.

NO PRYING • NO HAMMERING

PATENT APPLIED FOR

PERSSON MFG. COMPANY, 2 HENRY ST. BLOOMFIELD 4, N. J.

Just ONE setting per form

Just ONE continuous motion

• Prominent users tell us they consider "Fluidmotion" Radii and Angle Dressers the finest precision dressing instruments procurable — regardless of cost. They obtain greater accuracy, longer wheel life, and much faster set-up and operation.

We'll be glad to send you complete information. Write.

J & S TOOL CO. 477 Main St. East Orange 4, N. J.

Representatives in Principal Cities

"Fluidmotion"

FEATURES:

.0001" accuracy
Automatic Centering
"Fluidmotion" dressing
Dustproof and chatterless
Hardened stainless steel
7" and 14" wheel capacities
Highest quality diamonds

**Reg. U. S. Pat. Off.*

Peerless Machine Co. Metal is fed forward within a four-sided frame assembly. When the cut is completed, the conveyor feeds the pre-determined length of metal into the saw, the multiple bar-clamping vise releasing and setting automatically. Full details are given in Bulletin MC-51A available on request from PEERLESS MACHINE CO., Dept. 6-80, Racine, Wis., or use INFORM-A-GRAM Key No. 680-P.

HARDENING STEEL BY DIFFERENT METHODS is discussed in a new Bulletin No. SC-131 just issued by Surface Combustion Corp. It gives a brief resume of hardening practices and shows a photomicrograph of steel in the spheroidized and in the hardened state. Also ideal types of furnaces for various methods of hardening are shown. On request, copies of this bulletin will be sent from SURFACE COMBUSTION CORP., Dept. 8-10, Toledo 1, Ohio, or use INFORM-A-GRAM Key No. 810-P.

CARBIDE, ITS MANUFACTURE AND APPLICATION AS TOOL BITS is discussed and illustrated in a new catalog No. 29, issued by Willey's. Six grades of Willey's metal are produced, each for a certain type of cutting on various materials. Copies are available on request from WILLEY'S CARBIDE TOOL CO., Dept. 5-51, 1340 W. Vernon Highway, Detroit 1, Mich., or use INFORM-A-GRAM Key No. 551-P.

EASE OF OPERATION, PRECISION ACCURACY, RUGGEDNESS AND VERSATILITY are features of the new Universal Boardmaster drafting machine. "Centralized Control Group" locates every operating control at the fingertips of the left hand, all within a 2" radius. A system of cartridge stabilizers permits the tilt of the board through a range of 0°-90° without friction or drag. These new features are described and illustrated in literature available on request from the UNIVERSAL DRAFTING MACHINE CO., Dept. 21, Payne & E. 31st St., Cleveland 14, Ohio, or use INFORM-A-GRAM Key No. J21-P.

TESTING MATERIALS FOR TEMPERATURE REACTION, RELATIVE HUMIDITY SIMULATION, and high altitude simulation in the laboratory is facilitated by a series of new units developed by Bowser. These are described and illustrated in new literature available on request by engineers, plant managers and production men from BOWSER, INC., REFRIGERATION DIV., Dept. 26, Terryville, Conn., or use INFORM-A-GRAM Key No. J26-P.

SUGGESTIONS ON THE USE OF DIAMOND WHEELS are contained in a bulletin, titled "Diamond Wheels" issued by Diamonds and Tools, Inc. It covers coolants, speeds, mounting, dressing and truing. Also cataloged is the complete line of grinding wheels manufactured by them. Copies will be sent on request from DIAMONDS AND TOOLS, INC., Dept. 28, Affiliate of Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich., or use INFORM-A-GRAM Key No. J28-P.

DRILLING HARDENED STEEL without imparing the metallurgical properties of the metal is performed by a new drill developed by the Enesay Tool Co. It will cut through steel hardened to 68 Rockwell C as well as soft metals with equal facility. The drill is fully described and illustrated in literature available on request from the ENESAY TOOL CO., Dept. 25, 2240 Sepulveda Blvd., Los Angeles 23, Calif., or use INFORM-A-GRAM Key No. J25-P.

GAGE MEMBERS, BLAST NOZZLES AND ABRASIVES are some of the products made from Norbide. This material, made from coke and boric acid, is described and its uses explained in a brochure titled, "Norbide, The Hardest Material Made by Man." Copies will be sent on request from the NORTON CO., Dept. 5-45, Worcester 6, Mass., or use INFORM-A-GRAM Key No. 545-P.

CENTRIFUGALLY CASTING HIGH SPEED BORING BITS assures fine grain structure and increased strength. The high tungsten content together with chrome and vanadium hardened to 64 Rockwell impart a high red hardness. Literature may be obtained from SAMUEL S. GELBER CO., Dept. DJ, 542 Washington St., Chicago 6, Ill., or use our INFORM-A-GRAM Key No. H58-P.

TURNING, FACING, AND BORING OPERATIONS, at high cutting speeds with Rex High Speed Tool Bits are well explained and listed in a new catalog by CRUCIBLE STEEL CO OF AMERICA, Dept. 2-56, 405 Lexington Ave., New York 17, N. Y. The high red-hardness with tough resistance to shock and abrasive wear of Rexalloy tool bits permits a 25 to 100 percent increase in speed, feed or depth of cut. INFORM-A-GRAM Key No. 256-P.

FASTENING REMOVABLE AND HINGED PANELS is simplified by the new Shakeproof Q-Two Quick Operating Fastener. Consisting of only three parts, it is quick and easy to install, allows for variation in alignment, and compensates for sheet thickness variations. Engineering and procurement data is contained in Bulletin No. S-75 available on request from SHAKEPROOF INC., DIV. OF ILLINOIS TOOL WORKS, Dept 7-00, 2501 North Keeler Ave., Chicago 39, Ill., or use INFORM-A-GRAM Key No. 700-P.

CHECKING GAGES BY DIRECT MEASUREMENT is the function of Measuring Machine Type MUL-250 by Societe Genevoise D'Instruments De Physique. Bulletin 738 describes and illustrates the procedures in checking plug, thread, snap, ring and other gages. Copies of this bulletin are available on request from COSA CORPORATION, Dept. 250,

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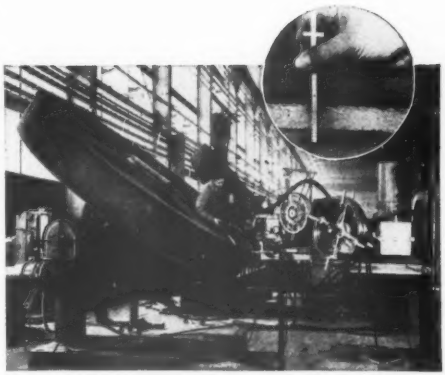
THE PROBLEM: A peripheral weld must be made on very heavy plates in one pass with deep and complete penetration . . . . with exact speed . . . . exact heat control to minimize heat distortion and stress.

THE SOLUTION: C-F Power Operated Positioners with Variable Speed Table Rotation from 0 RPM and up were used to revolve the work under a Unionmelt Type UE-21 automatic welding machine.

THE RESULT: Fully automatic welding which produced a clean, high quality fillet 1⅛ in. across the face (see inset) and 36 ft. in length in one pass. No machining or spatter removal was necessary.



If you need increased production, better downhand welding and lower costs in your welding department, C-F Hand or Power Operated Positioners should be your first choice. Write for Bulletin WP-22 and complete details. Cullen-Friestedt Co., 1316 S. Kilbourn Ave., Chicago 23, Ill.

C-F positioned welds mean better, more economical welds

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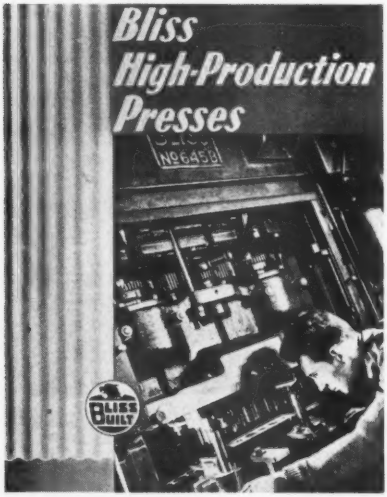
Chrysler Bldg., New York 17, N. Y., or use INFORM-A-GRAM Key No. 250-P.

"LOW TEMPERATURE" WELDING has many advantages which are explained in literature issued by Eutectic. Through the use of Eutectic Welding, high strength welds, often stronger than the parent metal, are obtained at application temperatures for lower than the fusion temperatures of the parent metals. Bulletin MF 1244, describing and illustrating the theory and application of this method, is available from EUTECTIC WELDING ALLOYS CORP., Dept. 81, 40 Worth St., New York, or use INFORM-A-GRAM Key No. 81-P.

INSTANTANEOUS HEATING OF THE SOLDERING TIP on the Flash Soldering Gun is attributable to the carbon heating element. It operates on 6-8v, therefore power can be taken from an automobile battery or through a transformer from 110v circuit. Literature giving full details is available from the BAKER-PHILIPS CO., Dept. 24, 3017 Lyndale Ave., So., Minneapolis 4, Minn., or use INFORM-A-GRAM Key No. J24-P.

PRODUCING, AUTOMATICALLY, LARGE QUANTITIES OF STAMPINGS requiring comparatively short and increased strokes per minute, is the function of the 600 series of punch presses engineered by Bliss. These



presses are illustrated and described in a new catalog No. 27-A just released. Also shown are typical specimens of a wide variety of complex parts stamped out of brass, steel and aluminum, with progressive and compound dies. Request copies from Mr. John J. Feely, E. W. BLISS COMPANY, Dept. 2-12, 450 Amsterdam St., Detroit 2, Mich., or use INFORM-A-GRAM Key No. 212-P.

STOPPING VIBRATION AND LEVELING MACHINERY is the function of Vibro-Levelers developed by Bushing, Inc. Types, sizes, and applications, as applied to punch presses, grinders, compressors, drop hammers, and other machinery, are described and illustrated in Bulletin BU-50. Copies will be sent on request from BUSHINGS, INC., Dept. 2-22, Royal Oak, Mich., or use INFORM-A-GRAM Key No. 222-P

MACHINABILITY, FREEDOM FROM DISTORTION AND DIMENSIONAL CHANGES, resistance to heat checking, service life, and type of surface finish transferred to product being manufactured, are terms in which permanent molds are measured. Meehanite has published Bulletin No. 23, entitled "Meehanite, the Metal for Permanent Molds", which describes and illustrates Meehanite Molds used in the production of metals, glass, plastics and rubber. A copy will be mailed upon request from MEEHANITE METAL CORP., Dept. 3-88, 800 Pershing Square Bldg., New Rochelle, N. Y., or use INFORM-A-GRAM Key No. 388-P.

DRILLING "TOUGHER-THAN-AVERAGE" JOBS can be performed by the new Chicago-Latrobe Heavy Duty Drill. These drills are designed to give top performance on drilling operations in the tough and hard materials such as heat treated steels up to 375 Brinell hardness. Full details on the drills are given in literature obtainable on request from CHICAGO-LATROBE TWIST DRILL WORKS, Dept. 5-67, 411 West Ontario St., Chicago 10, Ill., or use INFORM-A-GRAM Key No. 567-P.

TOOL HARDENING, GAGE STABILIZING, and shrink-fit assembly are facilitated with Bowser-Kold-Hold Industrial Chilling Units. Literature illustrating the units and describing their uses and application is available (to Engineers, Managers, and Production Men) on request from BOWSER, INC., REFRIGERATION DIV., Dept. 26, Terryville, Conn., or use INFORM-A-GRAM Key No. J26.5-P.

SOLVING ONE OF THE PLATING INDUSTRY'S GREATEST NEEDS is found in a new air-dry coating developed by Michigan Chrome. Known as Micrcotex, this air-dry rack coating is a thermoplastic insulating material which meets the requirements of all plating, anodizing, tannerizing, parkerizing and bonderizing cycles. Full information is given in literature available from MICHIGAN CHROME AND CHEMICAL CO., Dept. 30, 6340 East Jefferson Ave., Detroit 7, Mich., or use INFORM-A-GRAM Key No. J30-P.

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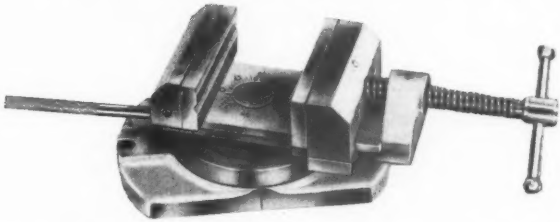

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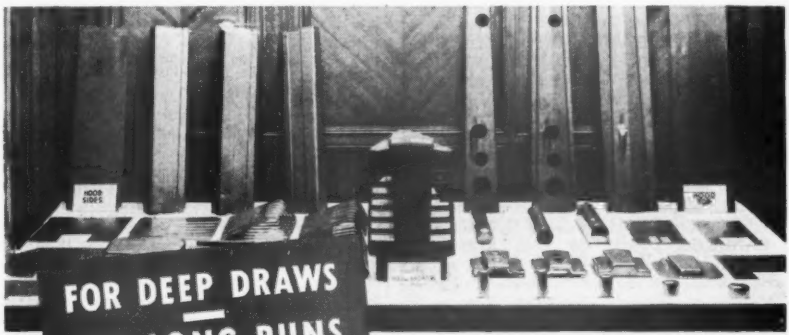

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There is a broad history back of ***Strenes metal*** and an interesting story to tell you. Write us.

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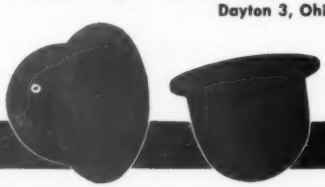


STRENES METAL
FOR DRAWING & FORMING DIES

developed by Lodge and Shipley. This machine is especially designed for quantity production of lathe work arranged between centers, on arbor, or in suitable chucks or fixtures. Yet it is equally adaptable to efficient handling of small runs. For complete details write (on your company letterhead) The LODGE AND SHIPLEY MACHINE TOOL CO., Dept. 46, Colerain Ave., Cincinnati 25, Ohio, or use INFORM-A-GRAM Key No. 46-P.

PRODUCING SMALL PARTS automatically with the Dunamatic Lathe Attachment is described and illustrated in a folder now available. The operating mechanisms include face cams, rocker arms, stock feeding cam and collets. These are shown and their functions explained. For full information write DUNN ENGINEERING CO., Dept. 40, 6341-A Lyndon Ave., Detroit 21, Mich., or use INFORM-A-GRAM Key No. H40-P.

CLAMPING WORKPIECES for production operations is demonstrated in a recent folder issued by Products Engineering. Products covered are self-adjusting toggle clamps, also drill bushings, machinists' tools and gages, and aircraft tools. Each of these subjects is in a separate catalog and all are bound in one folder. Copies will be sent on request from PRODUCTS ENGINEERING CORP., Dept. 1-58, 8511 Sunset Blvd., Los Angeles, Calif., or use INFORM-A-GRAM Key No. 158-P.

HARDENING, ANNEALING, DRAWING, CARBURIZING OR MELTING METALS, preheating high speed steels, melting or annealing glass and ceramic firing are operations performed with a new type heat-treating furnace. Designed for laboratories, small work shops, or school shops, it serves for production as well as laboratory use. Complete details will be sent by PERENY EQUIPMENT CO., Dept. 29, 842 N. Pearl St., Columbus, Ohio, or use INFORM-A-GRAM Key No. J29-P.

HANDLING LOADS OF 4000 AND 6000 POUNDS, by men or women operators, is easily done with the Barrett Powerox. Lifting and moving materials electrically does away with all necessary pushing, pulling, tugging and straining. The Powerox is described and illustrated in literature available on request from the BARRETT-CRAVENS CO., Dept. 9-82, 3255 W. 30th St., Chicago 23, Ill., or use INFORM-A-GRAM Key No. 982-P.

BORING, REAMING, INSIDE GROOVING, RECESSING AND CHAMFERING operations are performed by tools listed in a folder prepared by Davis. The folder is made up of four bulletins covering Expansion Block Type Boring Tools, Expansion "L" Type Boring Tools, Micrometer Adjustable Block Type Line Boring Tools, and Micrometer Expansion Car Wheel Boring Tools. Copies are available on request from the DAVIS BORING TOOL DIV. OF GIDDINGS & LEWIS MACHINE TOOL CO., Dept. 43, Fond du Lac, Wis., or use INFORM-A-GRAM Key No. 43.5-P.

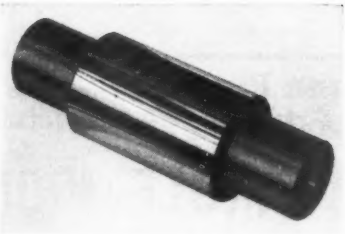
HEAT TREATING METALS to meet various conditions is discussed in a brochure issued by Heatbath Corp. A series of illustrations show the depth of case on a sample after Pen-Kay treatment for ½, 1, 1½, 2, and 4 hours, Pen-Kay being a scientifically proportioned bath carburizer that will produce a high carbon case to any desired depth in the shortest possible time. Copies of this brochure are obtainable free from HEATBATH CORP., Dept. 7-24, Springfield, Mass., or use INFORM-A-GRAM Key No. 724-P.

LONG WEARING HAND MILLING CUTTERS, ground from Solid Tan Tung, possessing a red hardness beyond the range of the best high speed steel, are described and illustrated in a catalog issued by Ferriot Bros. These cutters come in thirty-five shapes and from five to ten sizes in each shape. Copies of this catalog are available on request from FERRIOT BROS., Dept. 35, Akron 5, Ohio, or use INFORM-A-GRAM Key No. J35.5-P.

DATA ON SALVAGE OF WAR-TIME SURPLUS GAGES is given in one section of a new catalog published by Size Control. Also illustrated and described is their entire line of gages, new centerless lapping machine, and new gummed cut-outs of gages to be pasted on drawing paper for saving time in the drafting groom. Copies of this catalog, No. 846, are available on request from the SIZE CONTROL CO., DIVISION OF AMERICAN MACHINE & GAGE CO., Dept. 40, 2500 W. Washington Blvd., Chicago 12, Ill., or use INFORM-A-GRAM Key No. F40-P.

FORM GRINDING BALL GROOVE SCREWS, Taper Boring, and Application of Hydraulics to machine tools are three subjects treated in Ex-Cell-O Tool Tips for June 1946. Two large screws are illustrated which are parts of anti-friction lead screw assemblies in which steel balls are interposed between the hardened and ground lead screws and nuts. With this design it is possible to exert tremendous pressure and still retain extremely sensitive control. Tool Tips will be sent when requested on company stationery from EX-CELL-O CORP., Dept. 7-37, Detroit, Mich., or use INFORM-A-GRAM Key No. 737-P.

GOOD WEARING QUALITIES AND RESISTANCE TO ABRASION are characteristics found in Electric Furnace 52100 steel, an oil hardening grade of high-carbon chromium steel. This steel is fabricated in seamless tubes and used in the anti-friction bearing industry and for many general mechanical applications. Specifications and detailed information will be sent on request by STEEL & TUBE DIV., THE TIMKEN ROLLER BEARING CO., Dept. 5-73, Canton 6, Ohio, or use INFORM-A-GRAM Key No. 573-P.



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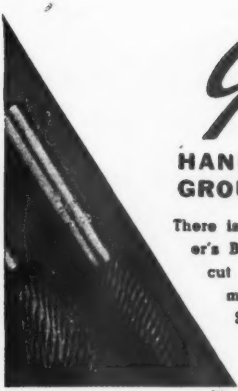

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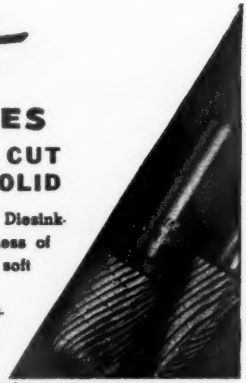

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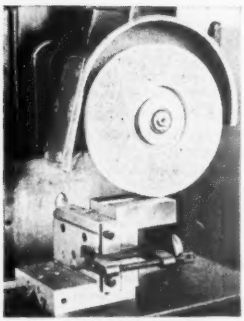

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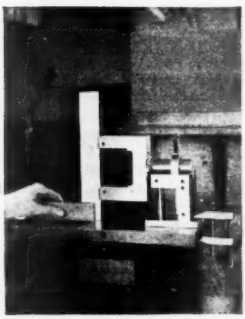

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THE TECHNIQUE OF CONTOUR SAWING and its applications in metal working shops is clearly demonstrated in a new booklet entitled, "DoALL Equals Ten Plus". This is a handy, durable 22-page booklet designed for ready reference on machining operations. It is a pictorial time study of metal fabricating short cuts. Graphic comparisons show how the productivity and life of more costly machine tools can be increased by relieving them of "hogging" operations that are performed more economically on DoALL Contour Sawing Machines. The DoALL is pictured on ten basic jobs: requiring internal, external, three dimensional, radius, circular cutting and finishing operations. Copies are free to anyone writing The DoALL Company, Dept. 696, 1301 Washington Ave., South, Minneapolis 4, Minn., or use INFORM-A-GRAM Key No. 696-P.

"MEEHANITE MEANS BETTER CASTINGS" is a 16mm sound movie providing definite engineering facts and figures about Meehanite castings, their types and applications. This 30-minute picture goes into the office of a metallurgist for the story of the foundry control in the production of Meehanite and demonstrates the rigidity of steel and Meehanite. It takes you into the foundry of the manufacturer and into the plants and machine shops of the users where these castings are at work. Nine important engineering properties are described and illustrated. Flame hardening and heat treatment are also discussed and illustrated.

Meehanite Metal Corporation, Dept. DJ, Pershing Square Building, New Rochelle, N. Y., will send a print of this picture upon request. If possible give alternate showing dates. INFORM-A-GRAM KEY No. 388-P.

SAFETY DIRECTORY & CATALOG is a complete, illustrated compilation of all safety, hygiene, first aid and fire protective products and devices. This vitally needed service, available for the first time, lists all the products, equipment and devices related to safety and accident prevention. It describes fully each product and its uses. It also gives the name of the manufacturer and provides a geographical list of local dealers and distributors.

The first annual edition will be ready in the fall of 1946, and should be of particular interest to management officials, safety directors, purchasing agents, insurance engineers and medical personnel. Copies may be reserved now with the Alfred M. Best Company, Inc., Dept. DJ, 75 Fulton St., New York 7, N. Y. Price $5.00.

"QUALITY THROUGH STATISTICS". The question of quality of output is becoming increasingly important to manufacturers in this postwar production period. The purpose of this book is to explain the usefulness of certain statistical methods in improving manufacturing quality. It is emphasized throughout the book that only the simple methods that can be readily comprehended in the work will prove satisfactory. For that reason, nothing complicated is presented. The majority of the plans outlined have proven to be extremely beneficial in practice.

This 60-page book was written by A. S.

Wharton and published by Philips Lamps, Ltd., London. Copies may be secured from The Gryphon Press, Dept. DJ, Highland Park, N. J. Price $1.50.

INTELLIGENTLY CUTTING METAL by hand or power hacksaws or by metal cutting band saws requires knowledge of the proper type of blade and number of teeth per inch for hand blades, and the correct pitch, speed and feed for power blades. This information is contained in a double sided metal cutting

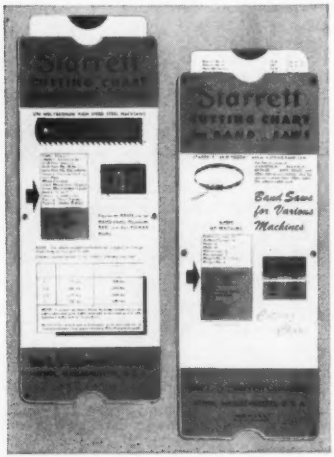


chart with a slide, which when set to indicate the metal to be cut, shows the necessary data for proper cutting, through a marked window. The charts are offered free on request by The L. S. Starrett Co., Dept. 699, Athol, Mass., or use INFORM-A-GRAM Key No. 699-P.

D. O. JAMES CATALOG 1000 contains 575 pages of practical power saving information, embracing complete engineering on design and application of the various types of cut gears, gear speed reducing transmissions and flexible couplings. Catalog 1000 also includes a 100-page engineering section containing tables, charts, and formulas that have proven useful in gear design problems. This catalog is now available, for distribution to organizations with gear and power transmission problems, on request from D. O. James Manufacturing Co., Dept. 23, 1140 W. Monroe St., Chicago, Ill., or use INFORM-A-GRAM Key No. J23-P.

CORRECTION. "Machine Tool Work" by William P. Turner and Halsey F. Owen, published by McGraw-Hill Book Co., was reviewed in the July issue of TOOL & DIE JOURNAL. The correct price is $3.00. Through an error in information supplied TOOL & DIE JOURNAL, $1.25 was published as the selling price.

"YOU'VE GOT SOMETHING THERE". One of the most entertaining and at the same time instructive booklets on a company's suggestion system has just been published by The B. F. Goodrich Company, Dept. TJ, Akron, Ohio, and is now available upon request.

Titled "You've Got Something There," the 20 pages of the booklet are enlivened by a series of cartoon sketches which bring home the point discussed on each page. Text is brief and to the point. Need for suggestions to better operations is first discussed, and the benefits flowing from such suggestions described.

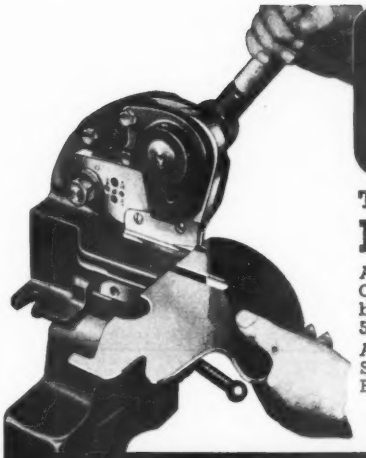
A review of the awards made during the last three years is one of the features. INFORM-A-GRAM Key No. A4-P.

ROLL IT, DON'T SLIDE IT. A hundred years ago bearings for both rotary and linear motion were just plain sliding bearings. For over fifty years, ball bearings have become universally used for rotary motion, but the slide remained for linear motion. With the development of the Ball Bushing, bearings for linear motion have caught up with rotary motion. Ball bushings are described and illustrated in an engineering data booklet, obtainable on request from Thomson Industries, Inc., Dept. 45, 29-05 Review Ave., Long Island City 1, N. Y., or use INFORM-A-GRAM Key No. C45-P.

DEVELOPING AXONOMETRIC DRAWINGS in either isometric or dimetric is simplified by the use of "Instrumaster" stencils. Since circles become ellipses in axonometric drawings, their representation is time consuming. These stencils have a wide range of sized ellipses in the correct plane for isometric and dimetric. They are fully described in a booklet by Paul F. Boehm, A.B., M.E., E.E., which is available from John R. Cassell Co., Inc., Dept. 27, Cassell Bldg., 138 E. 47th St., New York 17, N. Y., or use INFORM-A-GRAM Key No. J27-P.

"QUALITY CONTROL CHART TECHNIQUE when MANUFACTURING TO A SPECIFICATION" is a 73-page handbook written by B. P. Dudding and W. J. Jennett and published by The General Electric Co., Ltd. of England. The major aim of this technique is to assist production to specification requirements with the elimination of waste labor and material. It has proven to be an extremely valuable aid to economic production. While this handbook is intended principally as a guide for those concerned with machine manufacture of articles to dimensional limits, it should be helpful to anyone introducing the technique for use in other types of manufacture.

This handbook is distributed in the United States by The Gryphon Press, Dept. DJ, Highland Park, N. J. Price $1.00.



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Substitute the actual values

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and get the answer

D = .750168 inch.

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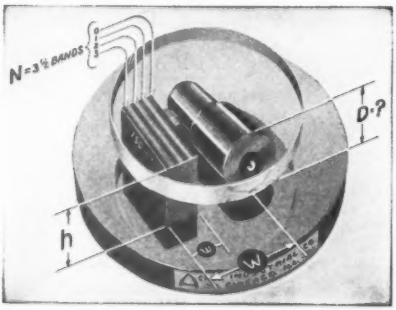

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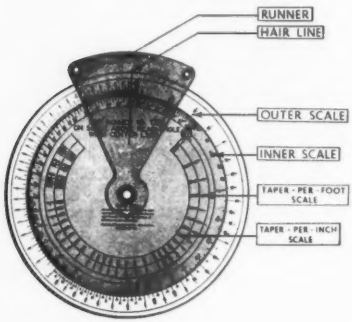
SELECTING THE WHEEL FOR ROLL GRINDING is discussed in a booklet recently issued by Norton. Grinding hot mill, cold mill, paper mill, jeweler and miscellaneous rolls are treated under separate headings. The surface and finish requirements, recommended wheels, and grinding helps are incorporated in each section along with other pertinent information. Upon request, copies of this booklet will be sent from the Norton Co., Dept. 5-45, Worcester 6, Mass., or use INFORM-A-GRAM Key No. 545-P.

THE INCREASING INTEREST IN THE USE OF HYDRAULICS as a means of power transmission has prompted the publication of an article entitled, "A Primer of Hydraulics", in the July 1946 issue of Hydraulic Progress. Illustrations graphically show the conditions which exist in a simple hydraulic system and also what takes place in the operation of a simple hydraulic press. A digest of what's going on in the field of hydraulics is also included. Copies of this bulletin are available on request from Superdraulic Corp., Dept. 82-5, Miller at Ford Rd., Dearborn, Mich., or use INFORM-A-GRAM Key No. H82.5-P.

COMPUTING ANGLES, TAPERS AND RELATED PROBLEMS is facilitated by the Angle Dial Rapid Calculator. Its operation is simple and should be valuable to the machine operator who has had little or no mathematical training, as well as those with considerable experience. Its principle is that of the circular slide rule with two scales for finding angles when legs of triangles are given. Taper per foot and taper angles are set up in two direct reading scales. With the taper per foot known, the angle of taper is read



from the adjoining scale. For full details write The Rule and Dial Co., Dept. TJ, 213 Marshall Ave., Collingdale, Pa. Price is $1.50 postpaid.

DETERMINING THE PROPER SPEEDS for drilling, reaming, milling, turning, or grinding is simplified by a new speed calculator recently announced by Lawrence Engineering Service. It is the slide rule type with three diameter scales graduated in inches, millimeters, and number and letter drill sizes on the slide. Upper scale of the body is graduated in fpm, cutting speed, and the lower scale in rpm, spindle speed. By setting the diameter value on the slide under cutting speed, the spindle speed is read off the lower

scale. Space 1" by 9½" available for advertising imprint. Single rules $1.00 delivered. Complete information may be obtained from Lawrence Engineering Service, 114 Snyder Ave., Peru, Ind.

OFFERED AS AN AID TO MANUFACTURERS WITH MATERIALS HANDLING PROBLEMS are the illustrated Lift Truck Job Studies published by Towmotor Corp. These studies report in detail the methods used by many leading manufacturers to speed up the materials handling system, with corresponding increases in efficiency and labor saving economy. Newest in the series is one covering the materials handling methods used by The Cleveland Graphite Bronze Company. It is available on request to Towmotor Corp., Dept. 4-95, 1226 E. 152nd St., Cleveland 10, Ohio, or use INFORM-A-GRAM Key No. 495-P.

HOW SERIOUSLY THE COMBINATION OF LOW DUCTILITY AND HIGH RESIDUAL STRESS affects the load-carrying capacity of welded joints connecting steel plates is the problem considered in detail in Bulletin No. 361, "Residual Stresses in Welded Structures", by Wilbur N. Wilson and Chao-Chien Hao, recently published by the Engineering Experiment Station of the University of Illinois. The new publication includes an analysis of various theories of residual stress, and complete reports on tests to determine the behavior of welded seams under loads, tests to determine the behavior under static loads of plates with circular welded seams, and fatigue tests of plates with longitudinal butt welds. For the present, copies of Bulletin No. 361 will be mailed free on request from the Engineering Experiment Station, Dept. 39, University of Illinois, Urbana, Ill., or use INFORM-A-GRAM Key No. J39-P.

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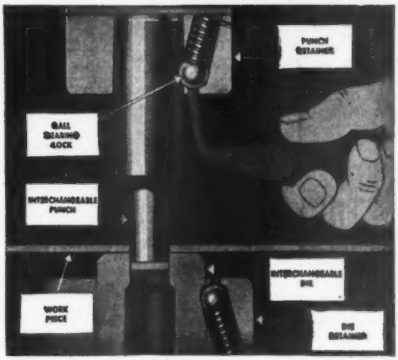

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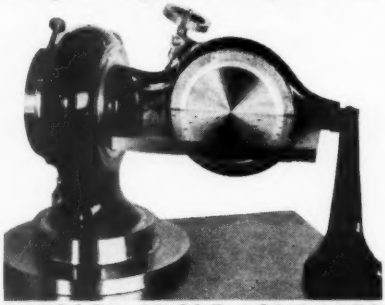

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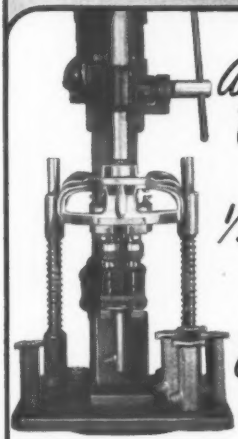

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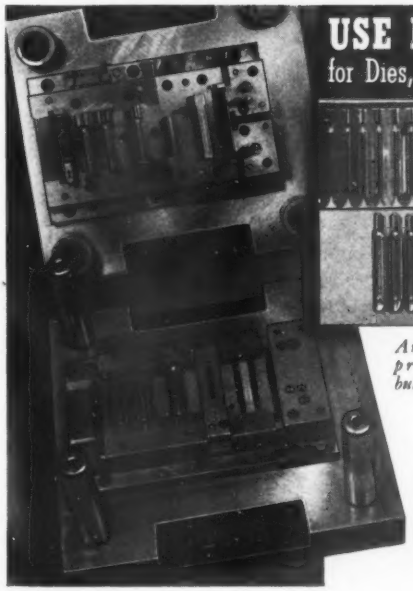

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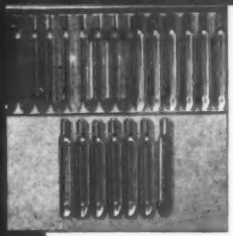

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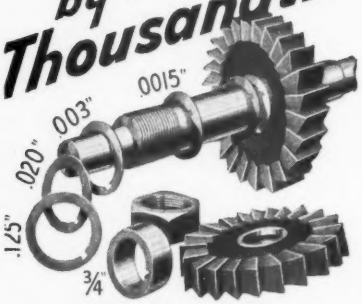

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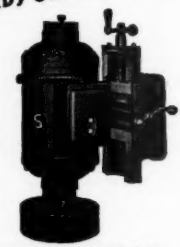

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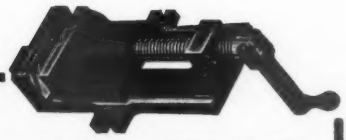

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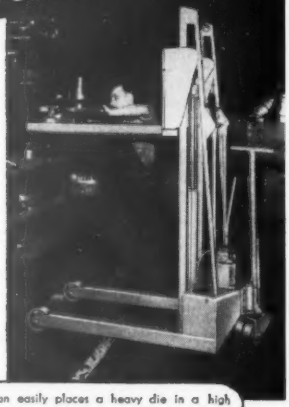

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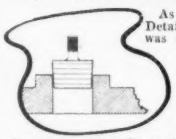

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13 plugs from ¼" to 1" in $\frac{1}{16}$" steps. Entering end of each plug .005" under nominal dimensions. Lines clearly indicate .001" steps progressively to top of gage or finish size.

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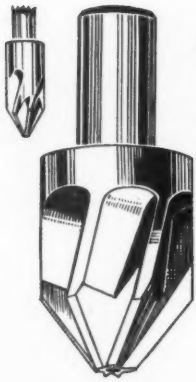

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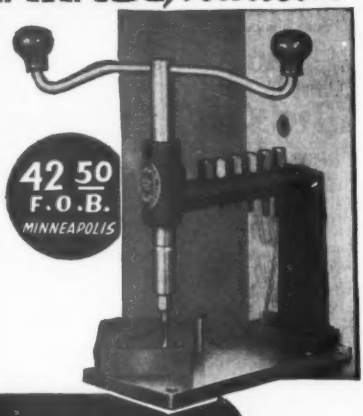

Dahlstrom TAP GUIDE

(CONTINUED FROM PAGE 83)
tion of such products as structural parts, bearings, contacts, etc., the designer strives to produce a flush surface between his die punches and cores. If this can be accomplished, the part can be swept across the die table surface into a suitable receiving chute without damage. If this condition cannot be accomplished for one reason or another, special pick-up mechanisms may have to be resorted to.

High molding pressures go hand-in-hand with high ejection forces. Thus the same expedients which help decrease pressures are also desirable from the ejection point of view. This is significant especially in parts which are sensitive to internal stresses. Both the die and the compact itself are under stress after the punch pressure is released. These residual stresses are released either suddenly or gradually during the ejection cycle. This usually results in an elastic decrease of the cavity dimensions and an increase of the compact dimension as the latter leaves the die. Tapering of the cavity helps a great deal in alleviating the resulting strains and proper selection of raw material may help overcome cracking as the result of these strains during ejection.

All the methods described have been used in production of powder metallurgy parts, which some years ago might have been considered impossible. Other methods are available in the form of special equipment, raw material, and processing cycles. On the basis of these developments in the molding of metal powders, it is reasonable to predict that more complicated and more accurate shapes can be handled as the need arises in the future. But, from the foregoing examples, one may recognize that there are no universally applicable rules on how to proceed in each case. New shapes and products often require a great deal of resourcefulness in order to devise new techniques for handling them.

1 R. P. Seelig, *Steel* 117, No. 21, 116, Nov. 19, 1945.
2 J. Wulff and R. P. Seelig, presented at the Annual Meeting of the A.I.M.E., Chicago, Feb. 1946.
3 C. G. Goetzel, Tech. Paper No. 1920, *Metals Technology* 12, No. 7, Oct. 1945 (see Powder Metallurgy Bulletin 1, 10, 1946).

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At last..a light punch press for large jobs!

20 TON CAPACITY!
7 INCH SHUT HEIGHT **3 INCH STROKE**

Designed to meet war production needs, this new Highland all steel punch press is *now available!* Because of its long stroke, 3", and its ample shut height of 7", this punch press handles those lighter tonnage jobs which heretofore had to be run on larger presses. The new Highland inclinable punch press features a 12" x 12" bolster with a 4½" diameter plug as standard equipment, an open back, a non-repeating trouble free clutch, and heavy bronze bearings. The highly stressed parts are made of 4140 alloy steel machine finished and heat treated to optimum tensile strength. The frame is made of welded and normalized 1" steel, heavily reinforced. A slight modification in the clutch mechanism will allow for automatic operation at 120 strokes per minute. The entire press occupies approximately 3½ square feet of floor space and weighs 800 lbs. (less motor).

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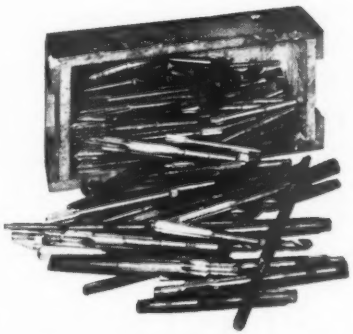

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FOR 34 YEARS WE HAVE SPECIALIZED IN RESTORING DRILLS, REAMERS, COUNTERBORES, MILLING CUTTERS, ETC., TO NEW USEFULNESS

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Your advertisement in *Industrial Plastics* will mean more sales per your advertising dollar. Write us today for detailed circulation information and your copy of the editorial index of the first twelve issues of *Industrial Plastics*.

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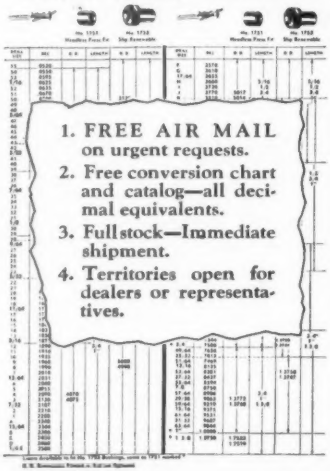
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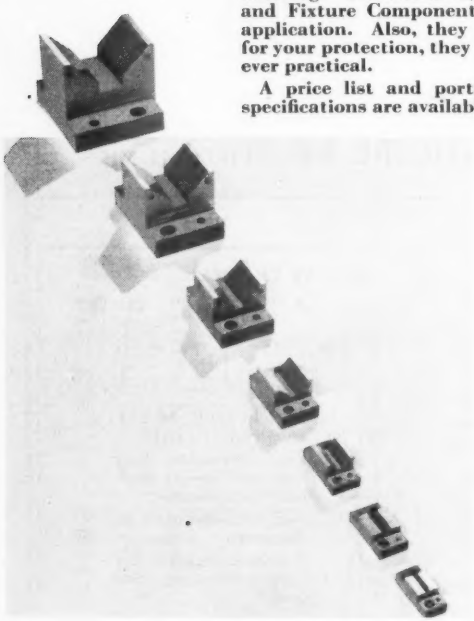
Standardize with these *TIME SAVERS* . . . Order Today

IMMEDIATE DELIVERY

At one-half your cost to build, you can stock in your own tool crib any or all "27 Varieties" of Noble & Stanton's *standardized* Jig and Fixture Components in a full range of sizes to meet your every need—just as you stock drill jig bushings and cutting tools. These *standard* parts, "*The Chrome Plated Line*", supplied with full size templates for tracing, can save their cost in your designers' time alone.

Noble & Stanton's large production runs and careful quality control assure strength and durability at costs far below custom building. Furthermore, Noble & Stanton's "27 Varieties" of Jig and Fixture Components are made of steels best suited to each application. Also, they are processed to precision standards and, for your protection, they are heat treated and chrome plated wherever practical.

A price list and portfolio containing actual size drawings and specifications are available upon request.



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Precision V-Blocks for Jigs and Fixtures

Seven sizes provide complete range for work diameters from 1/2" to 3".
Precision ground to dependable pre-determined standards and central to .0005".
"V"-ways hardened, rectangular slot left soft for clearance holes, stock left in dowel pin holes for reaming.

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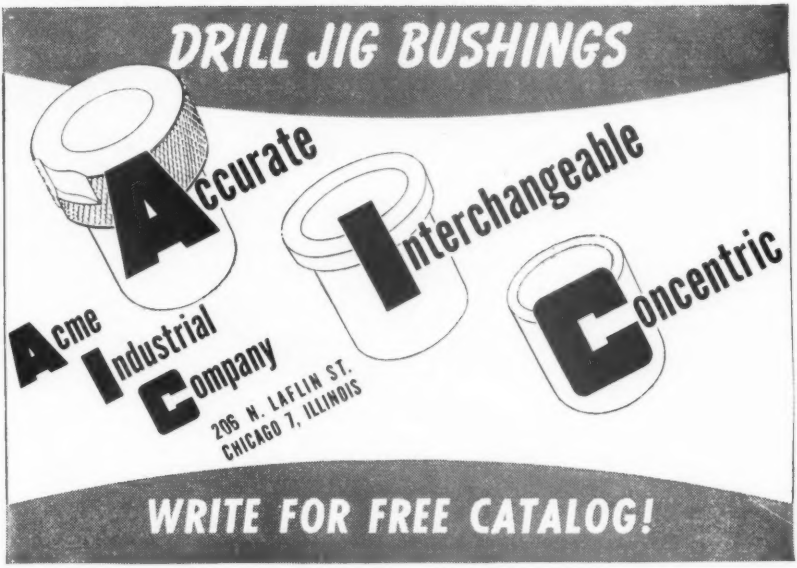

WHERE CAN I BUY IT ?

As a convenience for busy executives who read *Tool & Die Journal* at home, or during hours at the plant when stenographic help is not available, the publishers have provided a handy mailing card on the Inform-A-Gram insert page.

To inquire about any advertiser's product or service, simply fill in the "Where Can I Buy It" card and mail. No postage is required. We will see that your inquiry is forwarded without delay.

If you desire information on machines, materials, tools, equipment or services having to do with any phase of metalworking not mentioned in this issue, just describe the items on the "Where Can I Buy It" card. We'll endeavor to supply a reliable source from our extensive Buy With Confidence Files.

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SPEED PRODUCTION
STOP LEAKS
SAVE TIME

In thousands of leading factories, machine shops, foundries, etc., Air-O-chek Air Guns are *saving air, speeding production, reducing maintenance.* There are many reasons. Simple construction. The exclusive ball and socket joint between valve and enclosed lever which gives full discharge with *slight* flex of hose. Instant, positive shut-off. No outside levers or buttons. No packing gland. Just install a dozen Air-O-cheks and compare results.

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CERROMATRIX—250° F. For securing punch and die parts; anchoring machine parts; short run forming dies, etc.
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Burke motor driven milling machines Nos. 1, 2, 3, and 4 are specially suited for handling small, difficult work on a production basis.

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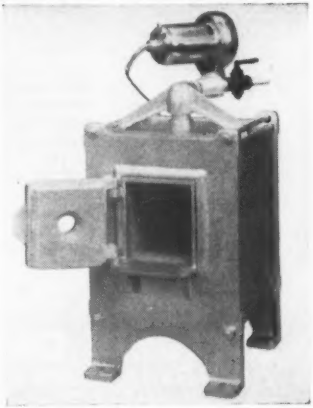
High Temperature Burner Furnace Heats Faster . . . . Saves Money



THE MIDGET UTILITY FURNACE

Heating chamber 4½" wide, 6¼" high, 9" deep; extra depth easily obtainable by change of plates; entire lining of standard insulating fire brick.

Here's a small, rugged bench furnace that's ideal for hardening small parts and tools, forging soldering coppers, general forging, brazing and a wide variety of other jobs. Because of its new type, high temperature burner it heats very quickly, saves real money. Complete rapid combustion; wide temperature range; maximum turn-down; burns any fuel gas; *2400° F in 12 minutes.* Equipped with blower (110v. AC-DC motor). Also available with mixing tee for compressed air (2 lbs. or more) or inspirator for high pressure gas.

Only $79.00 Complete

Prompt Delivery

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Flame Hardening with City Gas and Air
Industrial Gas Engineers

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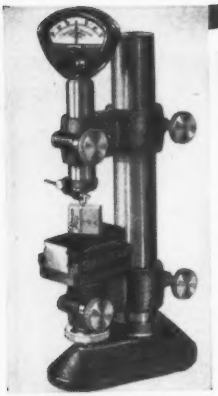

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FRICTIONLESS AMPLIFICATION

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RELIABLE
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LIGHT
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Complete elimination of friction, lag, and backlash insures positive, dependable repeat readings. Pointer responds instantly to the slightest movement of measuring tip, no swinging past true reading, no waiting for pointer to come to rest. No lights or electro magnets, no warm-up period required. No electrical connections, can be readily moved to different locations. GRADUATED: .0001" to .00001", .001 mm to .0002 mm.

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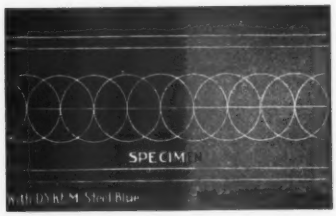

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STOPS LOSSES
making dies and templates

Simply brush on, ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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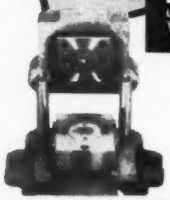
If you make ..
WASHERS
BY ALL MEANS USE
HOVIS
UNIVERSAL MASTER
WASHER DIES



Once you invest in Hovis Master Dies to meet your requirements,

then these 5 SMALL INTERCHANGEABLE PARTS are all you need to buy to make a new size washer.

Eliminate the cost of complete new dies. *Write for literature*

HOVIS SCREWLOCK COMPANY
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Phone: Centerline 1575 (Suburb of Detroit)

THEY DO DOUBLE DUTY

CHALLENGE
DUPLEX *Semi-Steel*
BENCH BLOCKS

PRECISION GROUND

With working surfaces both top and bottom these DUPLEX BENCH BLOCKS serve as ready-built bases for small fixtures and tools.

Made in three combinations—
1. Smooth on both sides.
2. Both sides grooved for lapping —½-inch mesh.
3. One surface smooth and the other grooved with ½-inch mesh for lapping metal-to-metal joints.

CHALLENGE DUPLEX BENCH BLOCKS are made of special analysis semi-steel with internal ribbing designed to insure them adequate strength. One standard size 10x14x2⅛-inches.

Hand-scraped at extra cost.

SE4

THE CHALLENGE MACHINERY CO.
"Over Fifty Years of Precision Equipment Manufacture"
Main Office and Factory — GRAND HAVEN, MICHIGAN

MIRROR FINISHES
in Minutes instead of Hours

On Tungsten Carbide, Tool Steels, Special Steels, Chrome, etc.

WITH STAR DUST

Laboratory Graded

Pure Diamond Powders and Diamond LAPPING COMPOUND

Produces super-finishes and polishes down to less than a MICRO-INCH with INCREDIBLE SPEED.

Write us your lapping problems. No obligation.

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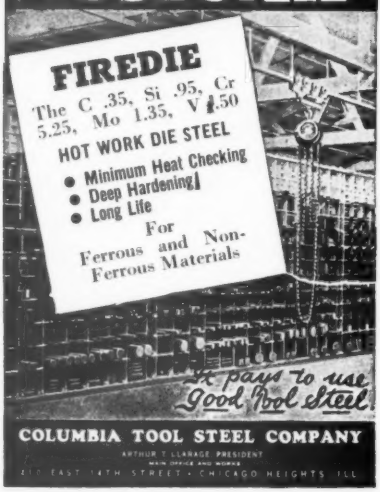
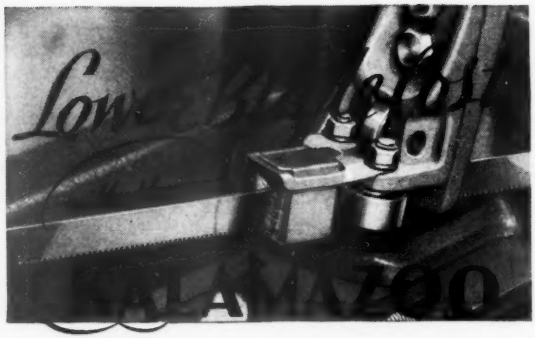
Columbia
TOOL STEEL


FIREDIE
The C .35, Si .95, Cr 5.25, Mo 1.35, V 1.50
HOT WORK DIE STEEL
• Minimum Heat Checking
• Deep Hardening
• Long Life
For Ferrous and Non-Ferrous Materials
It pays to use Good Tool Steel

COLUMBIA TOOL STEEL COMPANY
ARTHUR T. LLABAGE, PRESIDENT
MAIN OFFICE AND WORKS
2310 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

Metal Band Saw blades run into money, especially when a saw is in continuous operation. Kalamazoo engineers designed this machine to use the minimum length of blade needed to do efficient cutting. The reversible saw tooth cleaner and coolant attachment are also factors in increased blade life.



Comparative tests show that over a period of years there is a saving of 10 to 25 per cent on blade costs in the operation of Kalamazoo machines.

Ask your dealer or write direct for complete information.

MACHINE TOOL DIVISION
KALAMAZOO TANK & SILO CO., Kalamazoo 16, Mich.
In Canada — BRIDGE MACHINERY CO., Montreal

Kalamazoo *Metal Cutting* Band Saw

(CONTINUED FROM PAGE 97)

consistently good and accepted every time they come up for sampling. For example, if ten consecutive lots of the same item are passed, it is desirable to initiate a program of reduced sampling for that item. Figure 3 shows Systems Letter No. 46.1 covering instructions for reduced single-sampling, and one of the four tables accompanying this letter.

In order for the plant manager or the superintendent, as well as the chief inspector, to get a complete picture of the quality performance of the plant, it is desirable to maintain a single chart on which is charted weekly the percent defective for the plant or department, as shown in Figure 4. Some of the advantages of this complete program may be stated. Previous to the installation of this program, defects were running from 25% to 35%. After the program was in full operation, defects were reduced to an average of 1.35%. All of the inspectors on the second shift were eliminated. It was found that the first shift could adequately take care of the inspection.

Inspectors are now looking at all lots, whereas before the program was put into effect the policy was that "the wheel which sqeaked the loudest got the grease." This meant 100% inspection of items on which complaints had been received from customer departments and, because of the limited number of inspectors, other lots were passed without inspection. Detail inspection of all lots was obviously out of the question.

The best results, however, are the intangible results of a more cordial relationship between inspectors and line supervisors because complaints are no longer received from customer departments. The program has resulted in better quality, increased production, and lower costs—items in which the line organization is definitely interested. There is every reason to believe that this program, which has been used successfully, is sufficiently flexible to be applicable in most manufacturing plants with comparable results.

KNOW ALL THE ANGLES...
on your drills, reamers,
milling cutters, lathe tools, etc.
..and duplicate them at will!

The precision optical protractor for measuring exact angles on cutting tool edges.

- Assures new-tool efficiency on re-grinds.
- Makes duplication of angles easy.
- Checks for centering accuracy on cutting lips.
- Quick inspection of tools without removing from machine or grinder.

FREE FOLDER
Sent upon inquiry.
Write for your copy!

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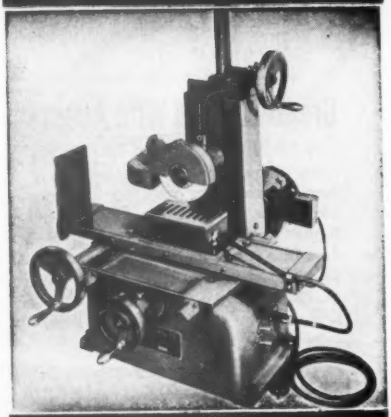
MANUFACTURERS OF OPTI-TOOLS

SANFORD



High-Speed BENCH
SURFACE GRINDER

ACCURATE WITHIN .0001

A sensitive machine built to rigid standards of accuracy and workmanship specially designed *"For the job that fits in your palm."*

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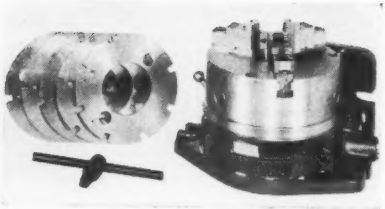
SANFORD MFG. CO.
1020-28 Commerce St.
Union, N. J.



Super-Spacer and Equipment

Greater Speed With Accuracy

HARTFORD "SUPER-SPACER"

So many different jobs can be done more economically with the Hartford Super-Spacer that it will pay you to investigate its possibilities for your shop. Standard equipment includes mask plates, reversible jaw self-centering chuck, sliding handle chuck wrench. It's moderate in cost. Write for illustrated applications bulletin.

THE HARTFORD SPECIAL MACHINERY CO.

DIAMOND IMPREGNATED

HONES

(Sintered Steel Bonded)

The life of carbide tools can be prolonged by lengthening the interval between regrinds. And this can be accomplished by touching up such tools lightly with FS Diamond Hones.

FS Diamond Hones are also recommended for shaping special contours on carbide form tools, where diamond grinding wheels do not suffice.

Hone is 6" long overall—diamond section being 1¼" x ½". For best results a 325-400 grit is recommended, and FS Diamond Hones are so stocked. Other grits from 100 to 600 also available.

Write for further particulars.

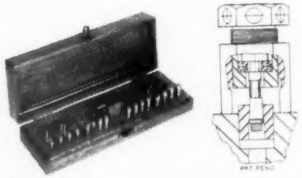
FISH-SCHURMAN CORPORATION
230 East 45th Street, New York 17, N. Y.

Fish-Schurman

DIE CASTING DIE DESIGNER

Immediate opening for die casting die designer. Experienced on zinc or aluminum dies. Must be thoroughly experienced in all phases of die cast die designing. Large well established manufacturer of electrical appliances located in N.E. Ohio. Living conditions good in small town or medium size city. Address replies giving complete personal and work history to Box No. HC-1.

It's New!



The Bolduc Extractor permits removal of pierce die inserts from dies without removing die from press or sections from dies.

These extractors have been engineered and developed to do a job in a manner not possible before.

In addition to pulling pierce die inserts, it may be used on ball bearings, sleeves, liners, etc., the merit of this tool has been proven by the many users in the field.

We solicit your extractor problems and assure prompt attention to inquiries.

BOLDUC SPECIALTIES CO.
10074 BEECHDALE DETROIT 4

No other filing machine like it!

MORE than a dream comes true with the use of the All-American Precision Die-Filing Machine. The WORK comes out true . . . first time and every time! Gone forever are endless trial setups and corrections. In a moment, the tool is trued to the work with file-setting square and universal joint die clamp—*exclusive with All-American*. Whether file, hone or saw, tool is supported against work by roller over-arm. Externally adjustable bearings—tiltable table—splash oil system—bench-to-bench portability. Superb engineering.
Ask for Bulletin 115.

Patented Universal Joint File Clamp

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Complete
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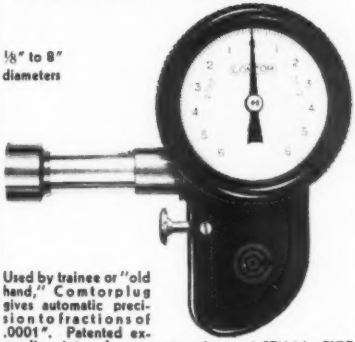
COMTORPLUG

⅛" to 8" diameters

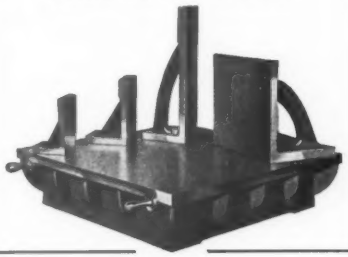


Used by trainee or "old hand," Comtorplug gives automatic precision to fractions of .0001". Patented expanding internal comparator shows ACTUAL SIZE (not a passing reading), front or back taper, out-of-round, bell mouth, etc. Rugged, practical for machine operators and bench inspectors.

Request New Bulletin 31

THE COMTOR CO.
82 Rumford Ave. Waltham 54, Mass.

MILWAUKEE
Surface Plates



A full line of surface plates, angles and box parallels. Standard plate sizes from 8" x 8" to 48" x 96", larger sizes with or without legs. Plates are finish-planed and scraped to insure a very accurate surface.

Write for details.

J. C. BUSCH CO.
Engineers & Machinists Since 1907
172 SO. FERRY ST., MILWAUKEE, WIS.

Quick Acting

Johnson

FURNACES

REDUCE TOOLROOM BOTTLENECKS

WITH SPEEDY JOHNSON UNITS!

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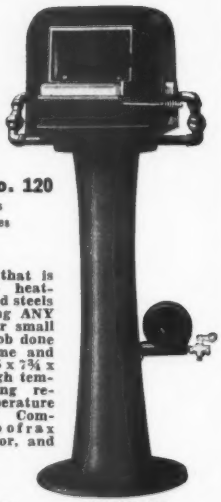
Harden high speed steels, tools, dies and small metal parts quickly and at LOW COST.



JOHNSON No. 120

1500°F in 5 Minutes
2300°F in 30 Minutes

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A low cost unit that is unexcelled for heat-treating high speed steels . . . for hardening ANY steel dies, tools or small parts. Gets the job done FAST to save time and gas. Firebox 5 x 7¾ x 13½ lined with high temperature insulating refractory. Temperature easily regulated. Complete with Carbofrax Hearth, G.E. Motor, and Johnson Blower.

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Write for Literature and prices on all Quick Acting Johnson Units

$129.50

F.O.B. Factory

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Please send Free Literature on all Quick Acting Johnson Furnaces.

Name .....

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WITH A **PALMGREN**

MILLING ATTACHMENT

Now — you can do milling, slotting, grinding, grooving, squaring shafts, sawing at angles, and many other important operations on your lathe. PALMGREN MILLING ATTACHMENT is a necessary fixture for small shops, schools and emergency work in large plants. Fits South Bend, Atlas, Craftsman, Logan, Sheldon and all other makes. It has graduation for rotary angle adjustments, also graduated feed and adjustment screw. Easily mounted by straddling lathe's regular tool post. Try one—it will quickly pay for itself.

No. 399

IMMEDIATE DELIVERY

Nos.	Width Jaws	Depth Jaws	Jaws Open	Weight Pounds	Fits Tool Post	Price F. O. B. Factory
150	1½"	1"	1⅝"	6½	1" Dia	$18.75
250	2½"	1 7/16"	2½"	11	1¼" Dia	24.75
400	4"	1½"	4"	25	2" Dia	39.75

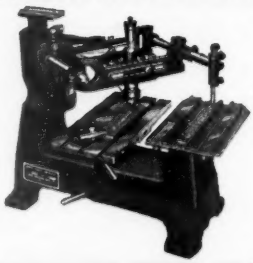
Order from your dealer or jobber.
Write for circular No. 350.

CHICAGO TOOL AND ENGINEERING CO.

Mfrs. of PALMGREN PRODUCTS for Over 25 Years

8388 South Chicago Avenue - Chicago 17, Illinois

HEAVY-DUTY BENCH-TYPE ENGRAVING MACHINE



THE PANTO MODEL UE-3

LIGHTER MODELS UE and UE-2

Interchangeable heads for pantographic engraving, electrical marking, and acid etching . . . available for all models. Also Panto engraving cutters, cutter grinders, master copy type, endless belts, and accessories.

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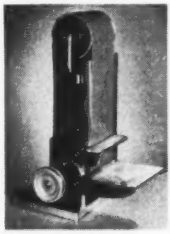
H. P. Preis Engraving Machine Co.

159D Summit Street, Newark 4, New Jersey

THE WOODS MODEL 40 BELT SANDER



A Husky Little Sander Able To Do A Wide Variety Of Jobs Performed On Larger, More Expensive Machines

Check These Superior Features

Bearings—Heavy duty New Departure dust sealed ball bearings throughout.

The only small sander with drive shaft supported on both ends of the shaft for longer bearing life and smoother operation.

Capacity—platen work area 5" x 8½" larger than any machine using a 36" belt.

Reversible platen—either face of platen can be used thus assuring a continual flat work surface.

Tool Grinder—a small rest for grinding tools is supplied.

Two positions—light weight of machine makes it easily operated in either vertical or horizontal position.

Pulleys—large weight aluminum 4" x 4½" to increase life of belt.

Positional platen 4" x 6"—adjustable to any angle.

Belt Tracking and tension are accomplished with simple thumb screws.

Shafting—supporting moving parts is ⅝" diameter and piston ground.

SPECIFICATIONS:
Standard Abrasive belt—4" x 35".
Bench Space—9" x 15".
Motor recommended—½ h. p.
Net Weight approximately 17½ lbs.
Shipping Weight—approximately 22 lbs.
Shipped F.O.B. our South Norwalk plant.
Standard equipment includes two working dams, the new reversible work platen, and 3 sanding belts in grits 80, 120 and 180.

WOODS ENGINEERING CO. • Norwalk, Conn.

THE INDICATOR WITH TWO READING FACES! REVOLVING HEAD!

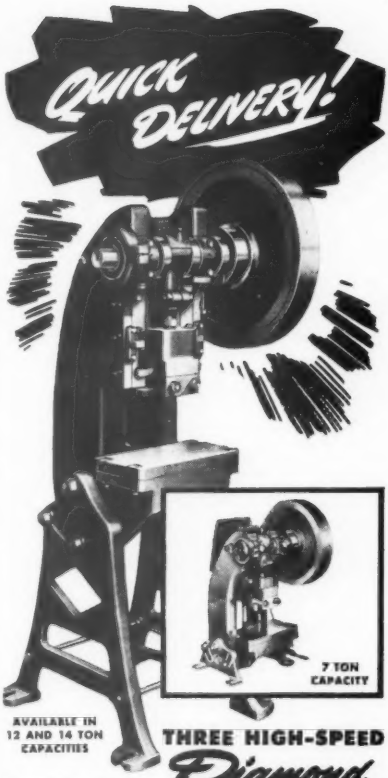
LUFKIN UNIVERSAL INDICATORS CAN BE USED AND READ IN ANY PRACTICAL POSITION.

Free Catalog

LUFKIN
FOR ACCURACY

THE LUFKIN RULE CO., SAGINAW, MICHIGAN,
New York City

QUICK DELIVERY!



AVAILABLE IN 12 AND 14 TON CAPACITIES

See our booth number H-246 at the National Metal Exposition at Atlantic City from November 18-26.

THREE HIGH-SPEED *Diamond* PUNCH PRESSES

In 7, 12 and 14 Ton Capacities

INCLINABLE, open-back type for all high-speed punching, stamping, forming, riveting and similar operations. Sturdiest, heavy duty type construction. Many advanced features. Fast, safe operation.

QUICK SPECIFICATIONS

MODEL	Standard Stroke	Shut Die Height*	Frame Opening	Flywheel Speed
7 Ton	1"	5½"	5½"	185 Max.
12 Ton	1½"	7¼"	6½"	150 Max.
14 Ton	2"	9"	6½"	150 Max.

*(Ram to bolster plate)

Longer strokes available. Write for circulars!

DIAMOND TOOL COMPANY
DEPT. G, 3429 E. OLYMPIC BLVD.
LOS ANGELES 23, CALIF.
Manufacturers of the DIAMOND Line of Precision Machine Tools and Accessories

HIGH PRODUCTION
AT LOW COST

REG U.S. PAT. OF.
HY-PRO
TAPS

By threading more holes per tap you can increase your production and lower tapping operation costs with HY-PRO Ground Thread Taps.

These high production taps are scientifically produced to give longer, more accurate service, and longer wear between sharpenings.

HY-PRO method of packaging makes crush-proof box a miniature tool box that fully protects taps and offers many time-saving advantages. Tension cover prevents spilling and injury to taps. Legible, informative labels are color-coded to save inventory time, and their position on cover prevents mixing of sizes when taps are returned to box.

PROMPT DELIVERY
Many special as well as standard taps in stock

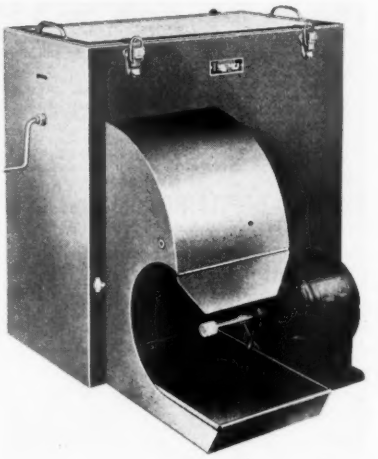
COMMERCIAL
PRECISION
SPECIAL
Ground Thread Taps

Write for Catalog on Company Letterhead

HY-PRO TOOL CO.
New Bedford, Mass., U.S.A.

Collecting Dust With Two-Stage Air Cleaner

A dust collector, requiring no installation except placing it in position on the bench and plugging it into the lighting circuit, is featured by the Aget-Detroit Co. Though designed primarily for bench type dry grinding of a precision nature, this Model 421 Dustkop has a wider range of uses. It is equipped with a self-cleaning paddle wheel fan so that buffing, polishing, and similar work producing long stringy material, lint, bristles, etc., can be easily handled. A removable pan in the grinding wheel hood allows sludge from wet grinding operations to be emptied separately, thus keeping it out of the collector.



The first stage of cleaning removes the heavier dust, dirt, etc., by means of the cyclone separator. The second stage is the fire-safe spun glass filter which gives the air a final cleaning to remove the finer particles of dust before it is returned to the room.

Additional information may be secured from Aget-Detroit Company, Dept. DJ, 602 First National Bldg., Ann Arbor, Mich. INFORM-A-GRAM Key No. 577-P.

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ON ALL SAWING—FILING AND LAPPING OPERATIONS

Savings in your toolroom time will soon pay the low initial cost.

The Oliver Die Maker cuts direct time cost of production from 50% to 60% . . . No toolroom is completely equipped without one or more of these machines. Now more than ever "you need an Oliver".

IMPROVE YOUR TOOLROOM IT'S THE BACKBONE OF PRODUCTION

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AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

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The COLOR tells the THICKNESS

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ARTUS Arbor Spacers made of plastic in various colors identify thickness at a glance! .001, .0015, .002, .003, .005, .0075, .010—.030. Speed up accurate fitting at low cost. Write for folder.

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● Established over a half-century ago to design and build fine surveying instruments *that had to be accurate*, The J. C. Ulmer Company has always made precision a *habit*.

Today this Ulmer habit of Precision Service is paying dividends to many of the outstanding industrial plants of America in the unsurpassed performance of their Ulmer-built tools, gages, jigs, fixtures and special machines.

Write today for our new folder, "Precision Service".

THE J. C. ULMER COMPANY
The Habit of Precision Since 1893
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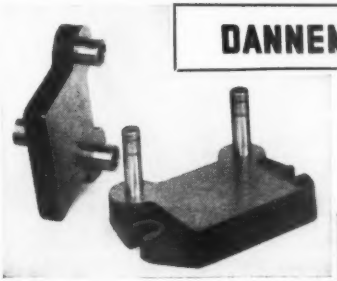

DANNEMAN *Precision* DIE-SETS

- Even inch punch and die space.
- Shank on center line of punch and die space.
- Machine finished clamping U-lugs.
- Distance of leader pins spread to allow stampings to fall through on inclined press operations.
- Die shoes and punch holders interchangeable.

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ACME-DANNEMAN CO., INC.
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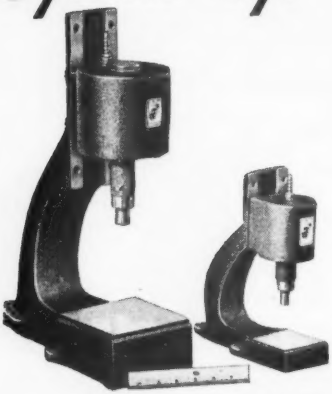
Speed Up Work with

MEAD AIR PRESS



These new Mead Air Presses deliver 400 and 1200 lbs. pressure respectively on 100 PSI. Handle many staking, crimping, assembly, and similar operations. Clearances 4" and 7½" respectively. With foot control these presses will speed up countless bench jobs, save muscular effort.

Write for new Air Power Catalog — just off the press.

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WAKCO-NOVOTNI WEIGHT RULE

enables you to calculate almost instantly the weight of a piece of metal in any size or shape. Covers aluminum, brass, cast iron, copper, lead, magnesium and steel, in balls, bars, cubes, fillets, hexagonal, octagonal, plates, prisms, pyramids, ¼ round, ½ round, round, wedges, etc. Rule made with all-white plastic with markings protected by overlamination of clear plastic. RULE in case with Instruction Manual $13.50

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20" Long x 12" Wide x 6¼" Deep 16 Ga., drag holes, handles both ends.

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Use artificial or natural gas or gasoline. Start without generating—"soldering heat in less than a minute." Schmidt "CONCEALED FLAME" Soldering Torches hold coppers steadily at any desired heat for continuous work. Very economical.

A moderate investment in Schmidt Equipment will step up production, reduce costs and increase profits. Send for circular.

For all Soldering Open Flame Work Brazing Branding Laboratory Use etc.

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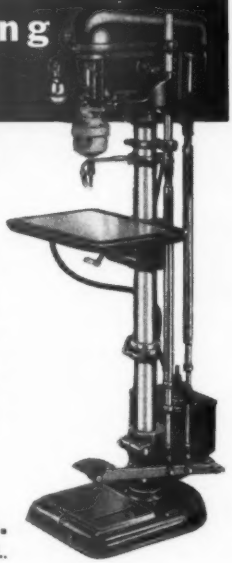
Faster, Better Tapping at *LOWER COST*



PROCUNIER TAPPING MACHINES

- **Practically Eliminate Tap Breakage**
- **Operate Continuously at High Speed**
- **Cut Rejections to an Absolute Minimum**

Low-cost Procunier Tapping Machines are the only machines with our compensating springs for the automatic adjustment of tap driving pressure. Pre-Set independent of the operator, two long spiral springs exert the desired pressure on the tap, regardless of pressure on the foot pedal. Tap breakage is all but eliminated, tapping is speeded up and consistent accuracy is maintained. An automatic lubricating mechanism delivers the proper amount of lubricant to the tap at the precise moment, washing all the chips away.

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- LESS DISCOLORATION
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What constitutes a better tracing paper? It's a tracing paper that is *uniformly* smooth, *more* pliable, *more* resistant to discoloration, with greater ability to present you with quality reproductions. And that is why W-V tracing paper is the better tracing paper . . . *it serves you.* Try W-V tracing paper today—buy it tomorrow.

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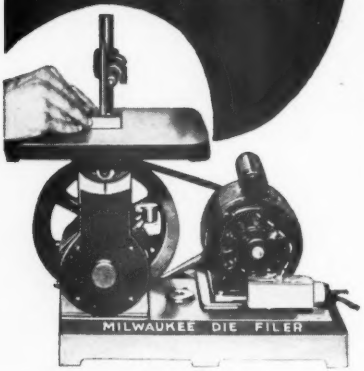
Reduces Die Costs!



The following "Economy Factors" make the Milwaukee Die Filer a real "Cost Cutter" for Tool, Die and Machine Shops, Foundries, Manufacturing Plants:

- Low First Cost
- Low Operating and Maintenance Costs
- Quick changeover from sawing to filing or vice-versa
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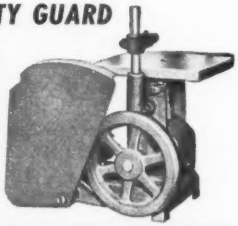
- Precision workmanship on filing, sawing or lapping operations

NEW SAFETY GUARD

One-piece, all-metal guard now available to all owners and purchasers of the Milwaukee Die Filer, at slight extra cost. Easily installed, it gives operator complete protection, yet does not interfere with speedy shifting of drive belt.



Milwaukee
CHAPLET & MANUFACTURING CO.
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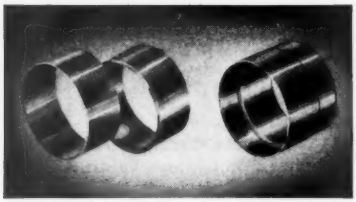
A 4861-½R

A FREE FIT . . . BUT NOT LOOSE



Laboratories that in peace as in war are pacing the advance of American industry demand accuracy above everything else. It is no wonder, then, that one of the largest laboratories in America came to Ace for these pressure support rings.

Here is a job that calls for exceptionally fine tolerances. The thin-walled ring had to fit snugly over the thick-walled ring—a free fit . . . but not loose. Not only was it necessary to hold close tolerances for size, but also for accurate concentricity. From the selection of special steel bar stock, through the machining, heat treating, grinding, and inspection operations, this was a typical Ace precision job.

Such jobs are merely a part of the daily grind at Ace, where accuracy applied to mass production was pioneered. Management skill and modern equipment are turning out tolerances as close as .0002" (which makes paper seem mattress-thick) and finishes which a speck of dust or a warm hand distorts.

If you are looking for a source of supply for small parts or assemblies from the tool and die stage—on through stamping, machining, heat treating and grinding, it will pay you to consult Ace. Ace will make you high-man in the coming competitive market. Send us a sketch, blueprint, or sample for quotation.

ACE
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ACE MANUFACTURING CORPORATION
for Precision Parts
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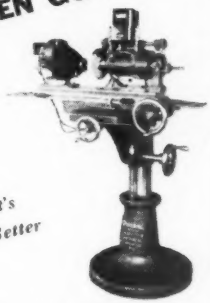
SHOP MEN GO FOR IT



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No. 4U Universal Grinder handles every grinding operation light or heavy within its capacity, with smoothness and efficiency. That's why the men in the shop like to use it, why they keep it busy. It's rugged, accurate, long-lived too. Moderately priced.

Bulletin No. 4 contains complete specifications. Write for your copy today.

PRODUCTION MACHINE COMPANY

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Work better

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Keep hands free

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Use of both eyes reveals true depth of details. Magnification of 2¼x. Free working distance, about 8", permitting unhindered use of hands. By just lifting your head, your eyes are free for any other activity. Eyeglasses may be worn while using. Highest optical quality. Eyeshade of Tenite—practically unbreakable.

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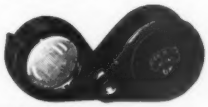

CARL ZEISS, INC.

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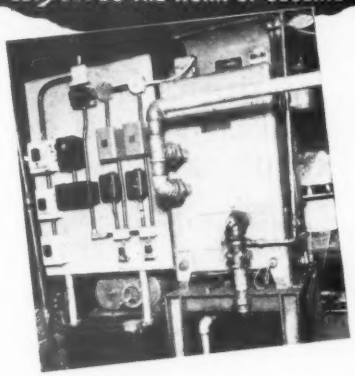

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Well designed and built to last, NIAGARA AERO HEAT EXCHANGERS have made an excellent record for reliability in service and freedom from maintenance trouble and expense.

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AIR ENGINEERING EQUIPMENT

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One Handy Set Speeds Set-ups To 12 Different Heights

Set includes six each of two sizes: 1" x 2" x 3" and 7/8" x 1-1/4" x 1-1/2"

This handy, compact set of Moore 3-Way Parallel Set-up Blocks takes the place of a large number of conventional parallels. Each block may be used in any of its three dimensions to build up to 12 different heights.

Spaced *around* the work-piece to provide support, parallel or perpendicular to working surfaces, they eliminate sagging, localize stresses and hold work rigidly throughout the machining operation. And they may be placed to avoid interference with holes being bored or ground.

Moore 3-Way Parallel Set-up Blocks are carburized chrome-nickel steel, finish-ground to +.0002"-.0000". Sides are parallel within .0001", perpendicular within .0002". Write for descriptive literature.

MOORE TOOLS

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1726 Union Ave. • Bridgeport 7, Conn.

MANUFACTURERS OF MOORE JIG BORER AND MOORE JIG GRINDER

TRY THIS "PAIR"

Bay State Handy Vise

—Precision made of hardened ground steel — light weight, yet sturdy, handles thick or thin work for tapping, drilling, grinding or jig-boring.

Bay State Hand Tapper

—needs no setup. Instantly ready for quick, accurate tapping, with minimum spoilage—proper spindle for every job.

Have many uses as a "Pair" or individually in any modern tool or die shop.

Write for descriptive circular

BAY STATE TOOL & MACHINE CO.
DEPT. A 417 ALBANY STREET, SPRINGFIELD, MASS.

MODELS—PATTERNS

Plaster Molds, Mock-Ups, Castings, Etc. for DUPLICATORS and FOUNDRIES

Made to your specifications from artificial stones, gypsum cements, and plasters

Write, wire or phone for accurate estimates and early delivery commitments

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Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 7 sizes U.S.S. Inexpensive — Last for years. Write for Circular.

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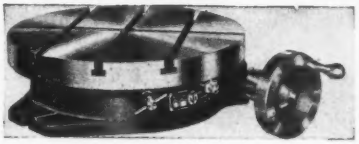
BRAND NEW PRECISION **ROTARY TABLES**



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12"— 160.00
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18"— 350.00 Extra Heavy Duty
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OUR ROTARY TABLE WILL TAKE THE PLACE OF A COSTLY FIXTURE. IT IS USED FOR ALL KINDS OF WORK ON MILLING MACHINES, SHAPERS, DRILL PRESSES AND HORIZONTAL BORING MILLS.

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with the
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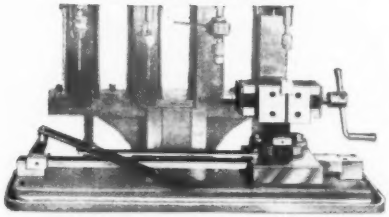

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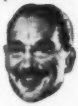

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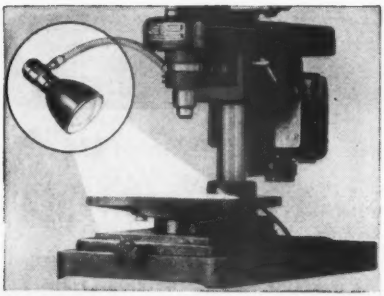

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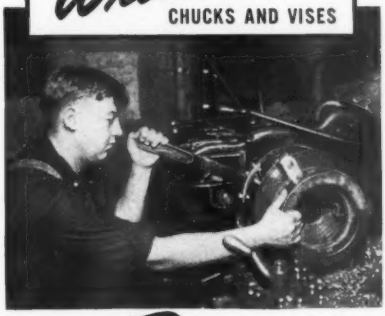

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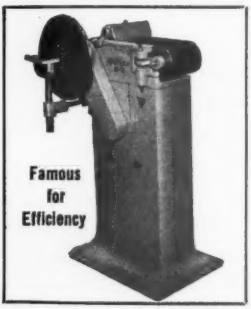

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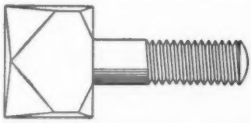

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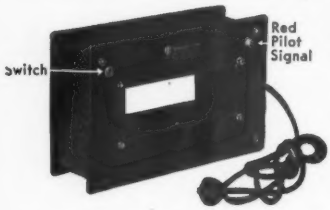

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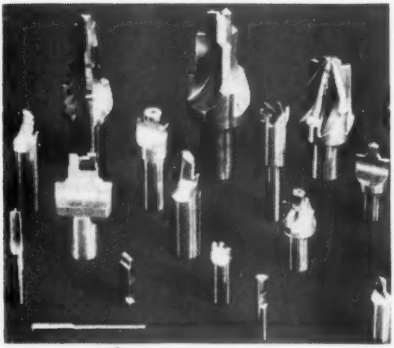

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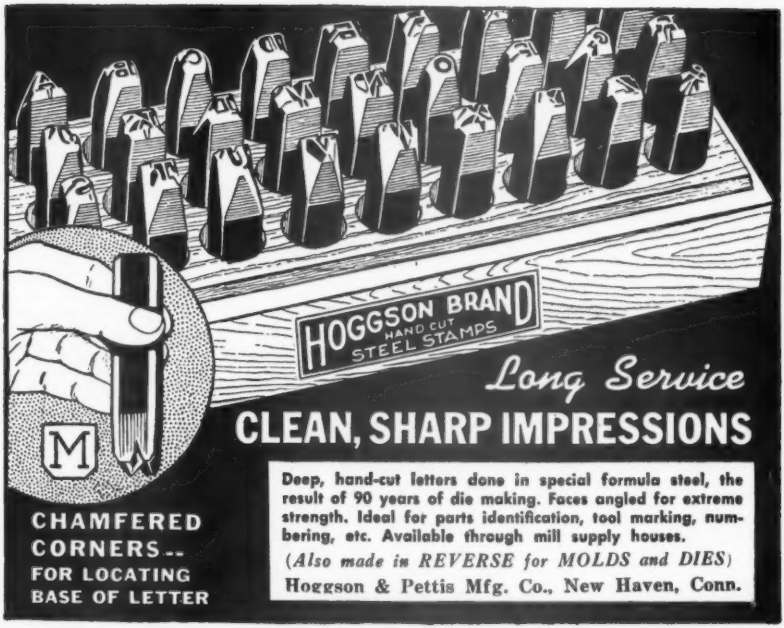

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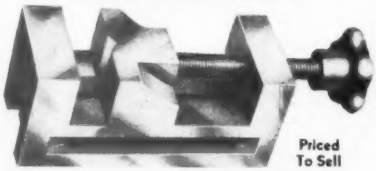

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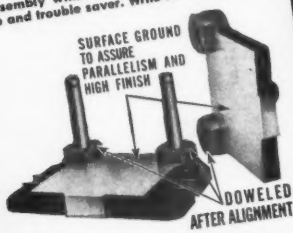

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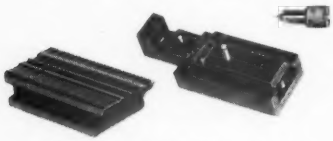

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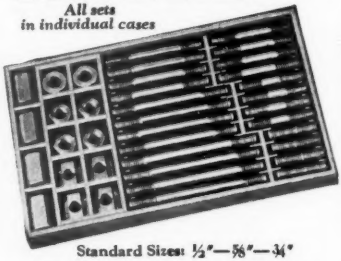

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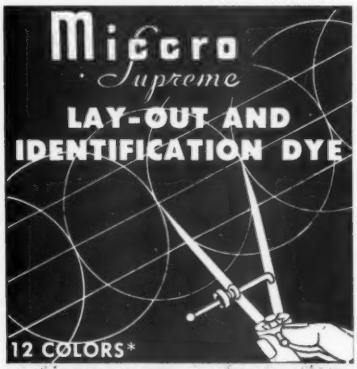

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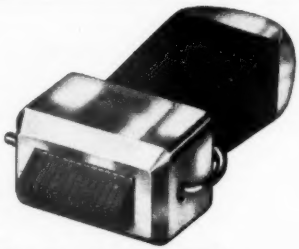

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FOR SALE: No. 100 Micromatic Hydrohoner; Banet Oil Separator; No. 6D Potter & Johnston Automatic Chucking and Turning Machine; No. 7 Fellows Gear Shaper; No. 13 Brown & Sharpe Universal & Tool Grinder. Address Box MS-946, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

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New Milling Machine Catalog

Milling machine catalog H13, containing complete information on their No's. 1H and 2HL machines, has just been issued by KEARNEY & TRECKER CORP., Dept. T-5, Milwaukee, Wis. The convenient controls, sturdy construction and simplified operation of these millers is herein well illustrated and described. Included are the Plain, Universal, and Swivel Head Vertical 1H and 2HL milling machines. Use of accessories and attachments which renders these millers widely adaptable and increases their productive value for many operations is also well explained. INFORM-A-GRAM Key No. 592-P.

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Three Portage Mills in the Columbiana, Ohio, plant of the National Rubber Machinery Company.

exceptional rigidity to maintain *"built-in"* accuracy

It makes no difference, on a Portage, whether the spindle is at the top or bottom of the column, the accuracy of its work will be equal to the "built-in" accuracy of the machine. This, you can depend on, because of the exceptional rigidity of a Portage horizontal boring mill.

To get this exceptional rigidity, Portage engineers designed a one piece bed with heavy ribs from floor line to top of bed, to provide the strongest possible foundation for the column. The column, itself, is especially large, so that the area of its base will provide greater strength and rigidity.

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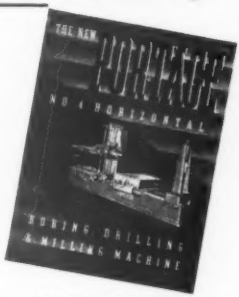

COMPLETE SPECIFICATIONS — and descriptions of the exclusive and unusual features of the Portage are contained in this booklet. Write today for your free copy.

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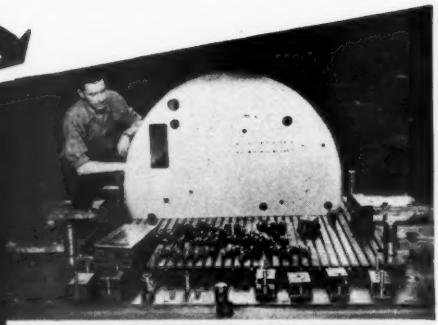
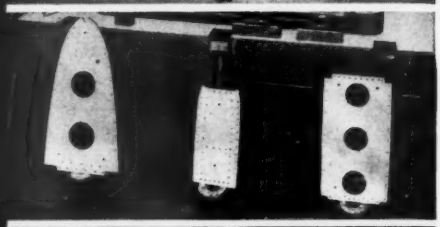


Re-use same WHISTLER ADJUSTABLE DIES in unlimited combinations



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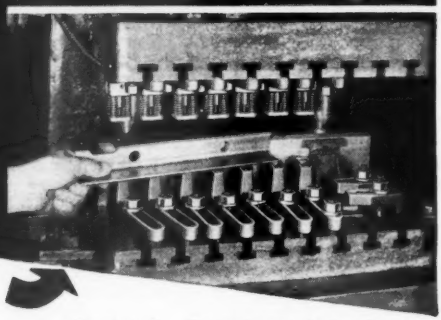

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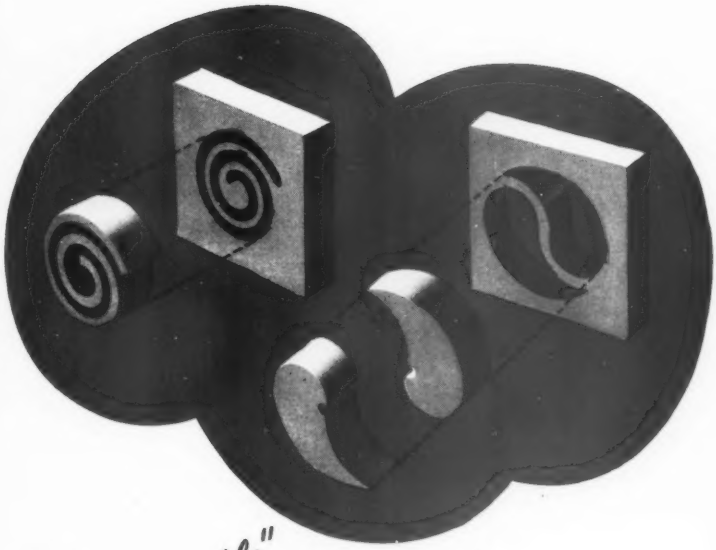

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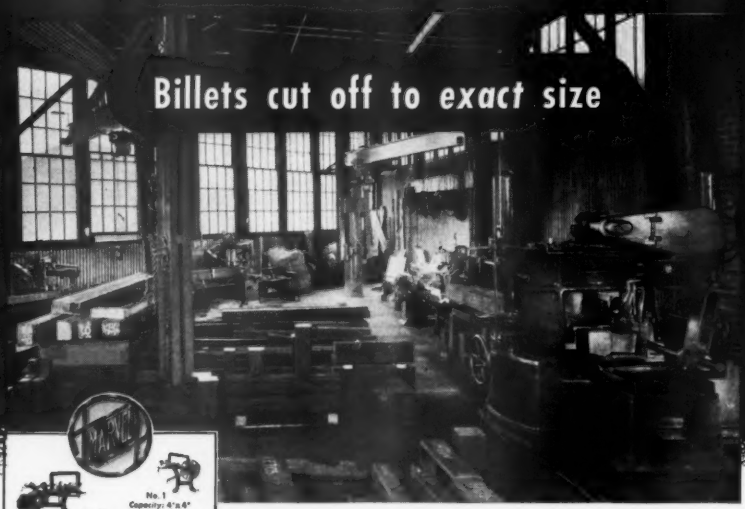

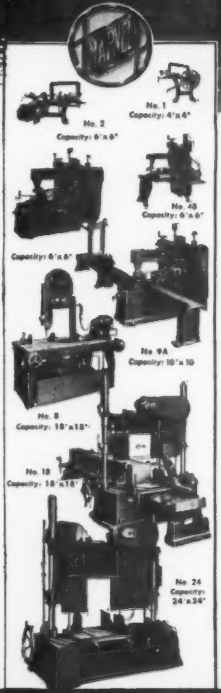

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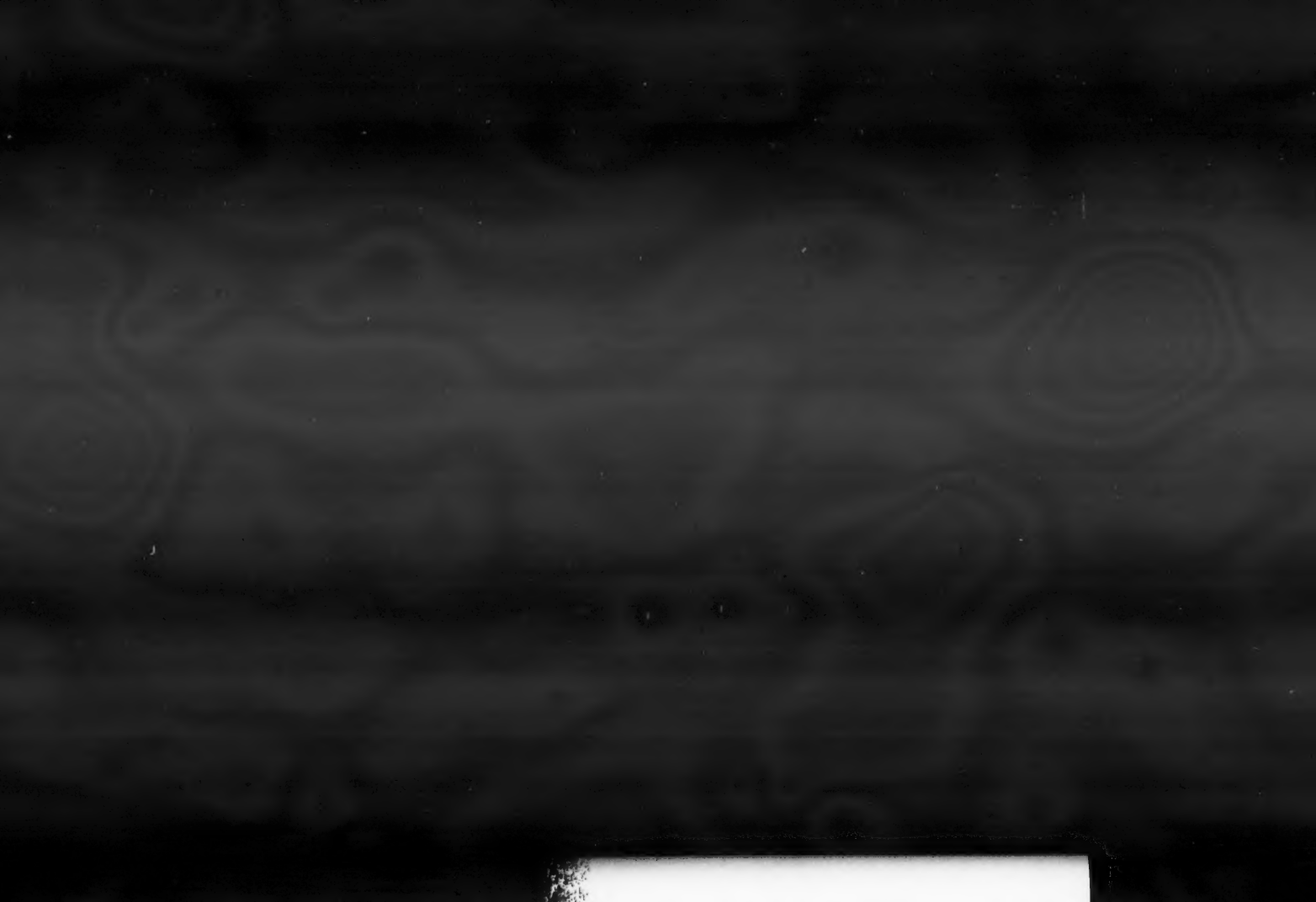
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